

APPENDIX IX

HAZARDOUS WASTE TANK SYSTEM ASSESSMENT,
DESIGN DRAWINGS, AND CONTAINMENT
CALCULATIONS

FOR

SIEMENS INDUSTRY, INC.

PARKER REACTIVATION FACILITY

PARKER, ARIZONA

Revision 1
April 2012

TABLE OF CONTENTS

<u>TAB NO.</u>	<u>DESCRIPTION</u>
1	Assessment of Tank Systems T-1, T-2, T-5, and T-6
2	Assessment of Tank System T-18
3	Certification of the T-Tank Containment Area

APPENDIX IX

TAB 1

Assessment of Tank Systems T-1, T-2, T-5, and T-6

Revision 1
April 2012



CHAVOND-BARRY ENGINEERING CORP.

400 County Route 518 • P.O. Box 205
Blawenburg, New Jersey 08504-0205

Tel: (609) 466-4900
Fax: (609) 466-1231

Tank System Engineering Assessment

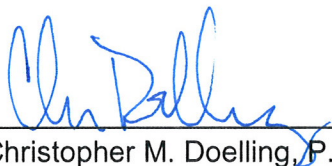
I have reviewed the information relating to the above ground tank systems identified in the document *Assessment of Tanks T-1, T-2, T-5 and T-6*, attached as Exhibit A, which are installed at the Siemens Industry, Inc. facility in Parker, Arizona, and my assessment allows me to draw the following conclusions in accordance with 40 CFR 264.192(a):

1. The tank system has sufficient structural integrity and is acceptable for the storing and treating of hazardous waste.
2. The tank system foundation, structural support, seams, connections and pressure controls (where applicable) are adequately designed.
3. The tank system has sufficient structural strength, compatibility with the wastes to be stored or treated, and corrosion protection, to ensure that it will not collapse, rupture or fail.

My assessment has been based, in part, on my review of the following information, which is provided in the attached document:

- A. Results of visual inspection and ultrasonic thickness testing for the tank systems.
- B. Hazardous characteristics of the wastes stored in the tank system.
- C. Structural calculations and design standards for the tank systems .

In accordance with 40 CFR 264.192(a) and 40 CFR 270.11(d), I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



Christopher M. Doelling, P.E.

April 23, 2012



Attachment: Exhibit A - Assessment of Tank Systems T-1, T-2, T-5 and T-6



CHAVOND-BARRY ENGINEERING CORP.

400 County Route 518 • P.O. Box 205
Blawenburg, New Jersey 08504-0205

Tel: (609) 466-4900
Fax: (609) 466-1231

EXHIBIT A

**ASSESSMENT
OF
TANK SYSTEMS
T-1, T-2, T-5 AND T-6**

40 CFR 264.192

Prepared for:

**Siemens Industry, Inc.
25323 Mutahar Street
Parker, Arizona 85344**

Prepared by:

A handwritten signature in blue ink, reading "Karl E. Monninger", is positioned above a horizontal line.

**Karl E. Monninger
Vice President
Chavond-Barry Engineering Corp.**

April 2012

ASSESSMENT OF TANK SYSTEMS T-1, T-2, T-5 AND T-6

Table of Contents

1.	Tank Systems Description	1
2.	Characteristics of Stored Chemicals and Compatibility with Tank Materials	2
3.	Results of Ultrasonic Testing and Visual Inspection	3
4.	Structural Calculations	9
5.	Deficiencies	11
6.	Recommendations	11

Appendices

A.	Tank Diagrams and Ultrasonic Test Results
B.	Hazardous Waste Characteristics
	Table 1 - EPA Listed Hazardous Wastes
	Table 2 - Spent Activated Carbon Organic Constituents
	Table 3 - Spent Activated Carbon Characterization
C.	Structural Calculations for T-1, T-2, T-5 and T-6
D.	Tank Support Structure and Foundation Drawings
E.	Tank Volume Calculations

ASSESSMENT OF TANK SYSTEMS

T-1, T-2, T-5, and T-6

In order to comply with the requirements of EPA 40 CFR, Subpart J, § 264.192, the visual inspections and ultrasonic thickness measurements were performed on the exterior of subject tank systems February 21, 2011 through February 25, 2011. Ancillary equipment including pipelines, fittings, flanges, valves, pumps and supports were also examined and visually inspected during this period. The results of the ultrasonic thickness measurements taken are shown in Appendix A. The following comments are made in conjunction with the EPA requirements:

1. Tank Systems Description

- A. The Siemens Industry, Inc. identification numbers for the tanks are T-1, T-2, T-5, and T-6. Each tank is 10'-0" in diameter with a 16'-0" straight side wall height, 8'-0" high nominal 62° bottom cone and umbrella roof (top head). Dimensioned drawings of the tanks are provided in Appendix A.
- B. All tanks are located outdoors on the east side of the control room and warehouse building. Each tank is supported by a carbon steel skirt and anchored to a common, elevated support structure. A caged ladder is installed on each tank for access to the roof.

The tanks and support structure are located within a secondary containment area that has sumps routed to the recycle water storage tank T-9 (not part of this evaluation). A portion of the tank system piping is also within this secondary containment area. The recycle water pumps, tank T-9 and the remainder of the tank system piping are located outside of the secondary containment area.

- C. The material of construction for the roof, cylindrical side wall and conical bottom of all tanks is 300 series stainless steel, specific grade unknown.

The material of construction for the stiffener rings and support skirt on all tanks is carbon steel. The exposed surfaces of the stiffener angle rings and both sides of the support skirt for each tank are painted.

The material of construction for pipelines and valves used for spent carbon slurry transport is stainless steel, grade 316L.

- D. All four tanks were fabricated by Wyatt M&B Works, Inc. in 1956 and put into service at Parker, AZ facility during August of 1992.
- E. All tanks operate at atmospheric pressure and at a maximum temperature of 150°F; therefore, the ASME code stamp is not required. A 4-inch diameter vent is provided on the roof of each tank and connected by CPVC piping to a common granular activated carbon (GAC) adsorption system (WS-1) for VOC control. A 3-inch diameter pressure relief safety valve with vacuum breaker is also installed on the roof of each tank. All of these safety valves are set at 8 ounces for pressure relief and at 6 ounces to break the vacuum.
- F. Each spent carbon storage tank has a design capacity of 8,319 gallons (31.49 cubic meters). A high carbon level sensor is located 4'-6" below the top of the cylindrical wall for each tank. An automatic safety valve on each of the two spent carbon unloading hoppers cuts off feed to the eductor system when spent carbon reaches the level sensor to ensure each of the tanks cannot be filled above the high level sensor. A 4" diameter overflow nozzle is located 1'-2" below the top of the cylindrical wall for each tank and directs excess recycle water to tank T-9 by gravity piping.
- G. The design standards and construction drawings for the tanks and ancillary equipment are not available.

2. Characteristics of Stored Chemicals and Compatibility with Tank Materials

- A. The spent carbon storage tanks (T-1, T-2, T-5, and T-6) are used to store spent activated carbon and recycle water in slurry form. The material is transferred into and out of the tanks by using eductors and a recycle water pump with a discharge pressure of approximately 85 psig.

The recycle water is maintained at a neutral pH (between 6 and 8) to minimize the corrosion.

- B. The spent activated carbon stored in these tanks is contaminated with various chemicals in low concentration, as listed in Appendix B. The

waste contaminants on the spent carbon treated at this facility vary in the range from < 1 to 300,000 ppmwd on average.

- C. The spent carbon storage tanks are constructed of 300 series stainless steel, specific grade unknown, resistant to all of the chemicals listed in Appendix B, and not susceptible to corrosion.

All four tanks were internally lined with Plasite 7122 HAR during the construction phase of this plant prior to startup during August of 1992. The Plasite lining is a cross-linked epoxy-phenolic cured with an alkaline curing agent. Although originally installed for its resistance to abrasion and a wide range of chemicals (acids, alkalis, and solvents), the Plasite lining is not required to protect the tank systems since 300 series stainless steel is compatible with all of the waste codes and hazardous constituents listed in Appendix B. Portions of the lining have likely been damaged during tank maintenance activities or worn away due to abrasion since the tanks were put into service; the existing condition and integrity of any remaining Plasite lining is unknown.

- D. All pipelines, valves and fittings used for the transfer of the spent carbon and recycle water slurry are constructed of stainless steel, grade 316L, resistant to all of the chemicals listed in Appendix B, and not susceptible to corrosion.

3. Results of Ultrasonic Testing and Visual Inspection

- A. To check the integrity of the tanks, ultrasonic testing (U/T) was performed on the exterior surfaces of the cylindrical wall, umbrella roof, cone bottom and support skirt for each tank to measure the shell thickness. Shell and cone bottom thickness readings were taken at a height of every two feet on each 90° quadrant. The results of the thickness readings obtained for tanks T-1, T-2, T-5, and T-6 are tabulated in Appendix A.

A Model NDT-715 ultrasonic thickness gauge (s/n 733351) and 5.0MHz dual element transducer (s/n AG766) were used for all thickness measurements; the manufacturer's calibration data for this test equipment are provided in Appendix A. Prior to each use (whenever the instrument was turned on) the sound-velocity for the material to be measured was set (0.233 in/μ-sec for carbon steel and 0.223 in/μ-sec for stainless steel) and

a probe zero conducted. To ensure the accuracy of all measurements, no thickness reading was recorded unless at least 6 of 8 bars were displayed by the gauge's Stability Indicator. Paint was removed from the test areas on the support skirt of each tank prior to thickness measurements.

- B. All four tanks were visually inspected from the exterior during plant operation and the following observations recorded:

1) Tank T-1

The tank's exterior surfaces and weld seams are in good condition with the exception of several small areas located adjacent to welds for carbon steel attachments where minor pitting and slight corrosion attack was evident. An area approximately 12" high x 8" wide is dented slightly inward at the 2-foot elevation on the west side of the cylindrical shell above a nozzle with a blanked off carbon steel elbow and valved city water piping connection. Two unused swirl jet nozzles located on the lower east side of the cylindrical shell are blanked off with carbon steel blind flanges. A carbon steel plate approximately 4" in diameter is welded to the cylindrical shell at the 8.5-foot elevation for closure of a nozzle that was previously removed. Four carbon steel support brackets, no longer in use have been cut off from the north side of the cylindrical shell but not completely removed by grinding. Unused nozzles and inspection/access ports on the top head of tank T-1 are sealed with stainless steel caps and carbon steel blind flanges.

As previously reported in the 1994 Tank Assessment, the two carbon steel stiffener angle rings (2-1/2" x 2-1/2" x 1/4") located at the bottom and 8-foot elevation on the cylindrical shell are corroded. In several areas, portions of the top horizontal flange on both stiffeners are disconnected from the remainder of the angle at the 90° bend. At other locations, the stiffeners are corroded at the bottom of the vertical flange of the angle. However, in all locations for both angle stiffeners at least 50% of the original material remains intact and the structural analyses performed (based upon a 2" x 1/4" flat bar) indicate they have sufficient strength. Exposed surfaces of the two stiffener angle rings and both sides of the support skirt are painted.

The minimum shell thickness for tank T-1 was determined to be 0.180 inches at the 0-foot elevation on the west side of the cylindrical shell.

2) Tank T-2

The tank's outside surfaces and weld seams are in good condition with the exception of slight corrosion attack in a few small areas located adjacent to carbon steel attachments on the shell. An area approximately 6" wide is dented slightly inward at the 10-foot elevation on the south side of the cylindrical shell. A carbon steel plate approximately 4" in diameter is welded to the cylindrical shell at the 8.5-foot elevation for closure of a nozzle that was previously removed. A carbon steel blind flange is used to blank off an unused nozzle located on the lower east side of the tank. Two swirl jet nozzles on the lower west side of the cylindrical shell are connected to the recycle water supply piping. Nozzles and inspection/access ports on the top head of tank T-2 are sealed with stainless and carbon steel blind flanges.

As previously reported in the 1994 Tank Assessment, the two carbon steel stiffener angle rings (2-1/2" x 2-1/2" x 1/4") located at the bottom and 8-foot elevation on the cylindrical shell are corroded. In several areas, portions of the top horizontal flange on both stiffeners are disconnected from the remainder of the angle at the 90° bend. At other locations, the stiffeners are corroded at the bottom of the vertical flange of the angle. However, in all locations for both angle stiffeners at least 50% of the original material remains intact and the structural analyses performed (based upon a 2" x 1/4" flat bar) indicate they have sufficient strength. Exposed surfaces of the two stiffener angle rings and both sides of the support skirt are painted.

The minimum shell thickness for tank T-2 was determined to be 0.183 inches at the 0.5-foot elevation on the north side of the cylindrical shell.

3) Tank T-5

The tank's exterior surfaces and weld seams are in good condition with the exception of several small areas located adjacent to welds

for carbon steel attachments where minor pitting and slight corrosion attack was evident. A carbon steel plate approximately 4" in diameter is welded to the cylindrical shell at the 8.5-foot elevation for closure of a nozzle that was previously removed. A carbon steel blind flange is used to blank off an unused nozzle located on the lower west side of the cylindrical shell. Two swirl jet nozzles located on the lower south side of the cylindrical shell are connected to the recycle water supply piping. Nozzles and inspection/access ports on the top head of tank T-5 are sealed with stainless and carbon steel blind flanges.

As previously reported in the 1994 Tank Assessment, the two carbon steel stiffener angle rings (2-1/2" x 2-1/2" x 1/4") located at the bottom and 8-foot elevation on the cylindrical shell are corroded. In several areas, portions of the top horizontal flange on both stiffeners are disconnected from the remainder of the angle at the 90° bend. At other locations, the stiffeners are corroded at the bottom of the vertical flange of the angle. However, in all locations for both angle stiffeners at least 50% of the original material remains intact and the structural analyses performed (based upon a 2" x 1/4" flat bar) indicate they have sufficient strength. Exposed surfaces of the two stiffener angle rings and both sides of the support skirt are painted.

The minimum shell thickness for tank T-5 was determined to be 0.167 inches on the south side of the cone bottom at location 1, approximately 1-foot below the cone/cylinder intersection.

4) Tank T-6

The tank's outside surfaces and weld seams are in good condition with the exception of slight corrosion attack in a few small areas located adjacent to carbon steel attachments on the shell. A stainless steel plate approximately 4" in diameter is welded to the cylindrical shell at the 8.5-foot elevation for closure of a nozzle that was previously removed. A stainless steel blind flange is used to blank off an unused nozzle located on the lower east side of the cylindrical shell. Two swirl jet nozzles located on the lower south side of the cylindrical shell are connected to the recycle water supply piping. Two small rectangular stainless steel patches are

welded to the cylindrical shell at 1.3 and 2.5-foot elevations on both the northeast and southwest sides of the tank. The patches range in size from 5" x 5" to 9" x 9" and were used to close holes previously created to aid in raising and supporting the tank during the repair of the bottom cone. Nozzles and inspection/access ports on the top head of tank T-6 are sealed with stainless and carbon steel blind flanges.

The original bottom cone section of tank T-6 has been replaced with a new cone fabricated from 1/4" thick type 304 stainless steel. The bottom three quarters of the old cone was removed and the new cone continuously seal welded to the remaining upper portion of the original cone from the inside of the tank.

As previously reported in the 1994 Tank Assessment, the two carbon steel stiffener angle rings (2-1/2" x 2-1/2" x 1/4") located at the bottom and 8-foot elevation on the cylindrical shell are corroded. In several areas, portions of the top horizontal flange on both stiffeners are disconnected from the remainder of the angle at the 90° bend. At other locations, the stiffeners are corroded at the bottom of the vertical flange of the angle. However, in all locations for both angle stiffeners at least 50% of the original material remains intact and the structural analyses performed (based upon a 2" x 1/4" flat bar) indicate they have sufficient strength. Exposed surfaces of the two stiffener angle rings and both sides of the support skirt are painted.

The minimum shell thickness for tank T-6 was determined to be 0.176 inches at the 16-foot elevation on the east side of the cylindrical shell.

5) Additional Information

Each tank is supported by a carbon steel skirt and anchored to an elevated structure at eight locations using 1-inch diameter structural grade bolts and nuts. The columns of the elevated support structure for the tanks are grounded by connection to underground grounding cable grids located beneath the secondary containment pad.

No structural defects, settling or distortion of the elevated support structure or foundation for the tank systems was observed.

The bottom of each of the four T-tanks are located approximately 6'- 0" above the secondary containment pad. The bottom of each of the six support columns for elevated structure are located 1' - 4" above the secondary containment pad. None of the external tank shells or any external metal component of the tank system is in contact with soil or water.

The existing pressure/vacuum relief valves for tanks T-1, T-2, T-5, and T-6 were replaced with new valves on May 11, 2011. The new valves (same model and type) are set at 8 ounces for pressure relief and at 6 ounces to break the vacuum.

Two new carbon steel vacuum stiffener angle rings (2-1/2" x 2-1/2" x 3/16") were attached to the cylindrical shell of each tank approximately 21-1/2" above the location of the original stiffeners. Installation and painting of the new stiffeners on the four tanks was completed on June 29, 2011.

D. Ancillary Equipment

- 1) The nozzle connections and piping for spent carbon slurry, recycle water, city water and vent were carefully examined during the inspection of each tank system and indicated no leaks.
- 2) Each of the two recycle water pumps (located adjacent to tank T-9 and outside of the secondary containment area) were found to leak at the packing seal for the pump drive shaft during operation. The leaks are intentional and comprised of city water used for cooling and flushing the seal gland of each pump.
- 3) The exterior surfaces of stainless steel pipelines and fittings are not painted and showed no signs of corrosion.
- 4) Pipelines are supported throughout by hanger supports and steel bridge supports, and are guided using "U" bolts.

4. Structural Calculations

- A. A finite element analysis (FEA) of the tanks was performed for the operating condition (1.5 specific gravity slurry to fill line) and based on the minimum shell metal thicknesses measured for each of the major components (top head, cylindrical wall and bottom cone) on any of the four tanks with wind and seismic loadings calculated from the latest edition of the International Building Code. The calculated FEA stress results are all less than allowable stresses from AWWA D100-05.

In addition to the FEA/AWWA evaluation, a second analysis was performed base on the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. The Section VIII, Division 1 analysis was conservatively based on an internal pressure of 15 psig plus the hydrostatic pressure of the spent carbon slurry and shows that the basic Code limits are satisfied.

A complete copy of the structural calculations and analyses is provided in Appendix C. Both analyses demonstrate that tanks T-1, T-2, T-5 and T-6 are acceptable for the atmospheric storage of spent carbon slurry.

Stresses due to seismic loading are higher than the stresses from wind loading, but the seismic stresses for the tanks are well below the allowable limits and relatively low when compared to those attributable to the weight/hydrostatic pressure. The structural analyses indicate that the critical component is the thickness of the cylindrical side wall of the tank at the cone/cylinder intersection where the hydrostatic loading produces a localized compressive hoop stress of 6,126 psi, which is 85% of the allowable local buckling stress of 7,209 psi (from AWWA D100-05) for a 10' - 0" diameter cylindrical wall that is 0.176" thick.

Note that the minimum actual thicknesses of the cylindrical wall for each of the four tanks at the cone/cylinder intersection is greater than the 0.176" thickness used in the FEA calculations as follows: 0.180" (T-1), 0.190" (T-2), 0.192" (T-5) and 0.208" (T-6). Since the allowable local buckling compressive stress is a function of the cylindrical wall thickness/radius ratio, the allowable stress at the cone/cylinder intersection for each tank increases such that the actual stress of 6126 psi calculated for the operating condition ranges from 73% to 80% of the allowable local buckling stress from AWWA D100-05.

For any of the four tanks, the maximum allowable stress at the cone/cylinder intersection will be equal to the calculated compressive stress if the cylindrical shell wall thickness decreases to 0.157" at that location. The maximum decrease in the tank cylindrical shell wall thicknesses since the 1993 measurements was found to be 0.028" (on the west side of T-2 at 2' elevation) and yields a maximum "thinning" rate 0.00156" per year. If the thickness of the T-1 cylindrical shell at the cone/cylinder intersection decreases at this accelerated rate, the remaining useful life of T-1 would be 15 years.

- B. The corroded vacuum stiffener ring located at the bottom of the cylindrical shell of each tanks is adequate for the shell to cone junction reinforcement. The calculations are based on 2" x 1/4" flat bars in lieu of the two corroded 2-1/2" x 2-1/2" x 1/4" stiffener angles on each tank.
- C. Piping drawings showing the thicknesses, layout dimensions, and the supports are not available, but based upon visual inspection, excessive stresses due to thermal expansion, settlement, and vibrations were not observed. All pipelines appeared adequately supported and guided. Therefore the piping systems do not appear to cause any threat of leakage.
- D. All tanks are supported on the elevated structure, which was designed by LuMar Engineering Co. of Pasadena, California. The structural and foundation drawings are provided in Appendix D.

Each of tanks T-1, T-2, T-5, and T-6 are supported by a continuous skirt support which give uniform load distribution to the W12x26, W21x44, and W24x55 braced beams by means of eight point loads and all structural columns are supported on a mat foundation that is 2' - 6" deep per the LuMar drawings.

Based upon the absence of any observed defects, settling or distortion of the elevated support structure or foundation that have been in continuous service since 1994, the structural support and foundation for the tanks appear to be adequate.

5. Deficiencies

No deficiencies that would compromise the integrity of the tanks for the atmospheric storage of spent carbon slurry were found.

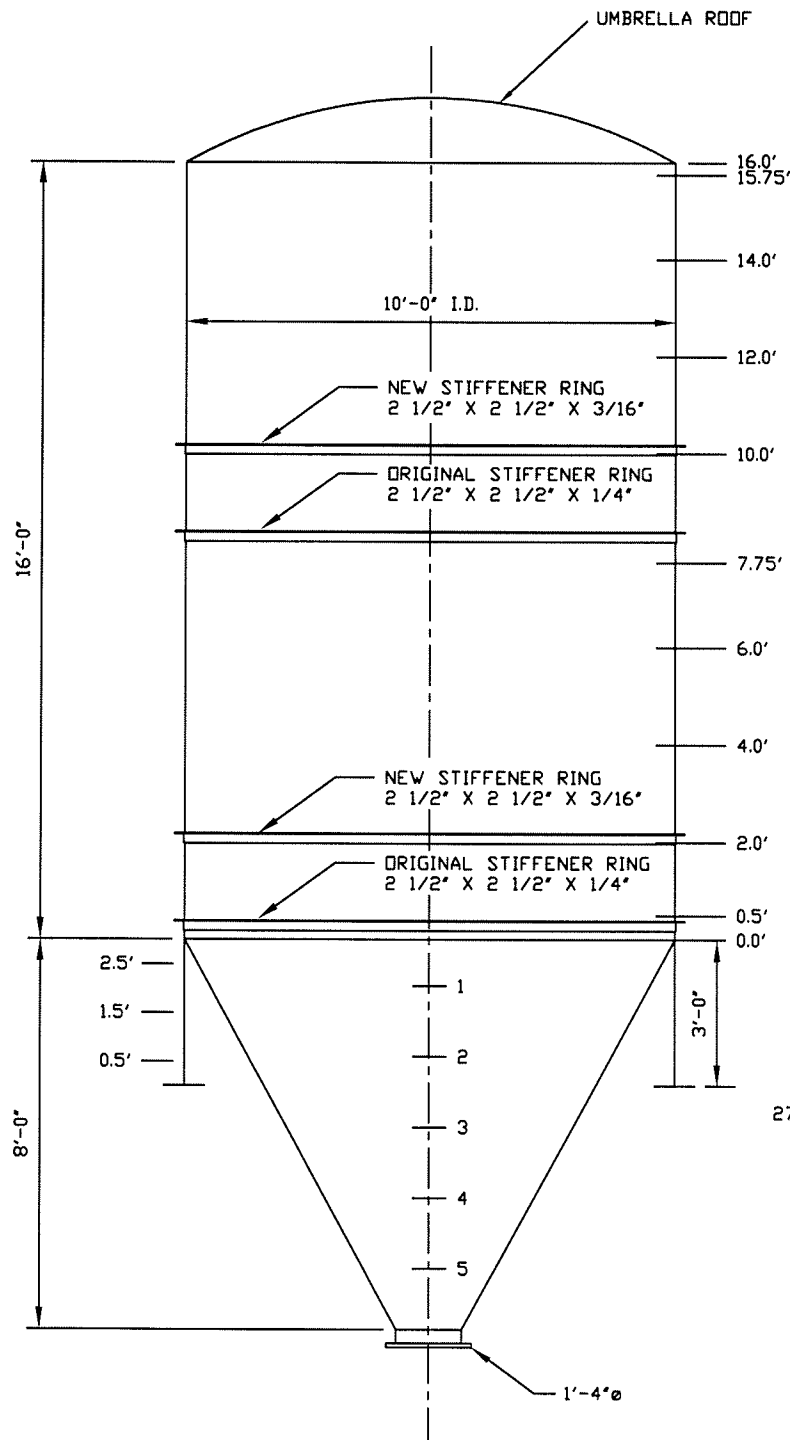
6. Recommendations

- A. Continue daily monitoring and visual inspections of the spent carbon storage tanks and ancillary equipment for compliance with RCRA requirements.
- B. Conduct annual ultrasonic thickness testing at the bottom of the cylindrical wall above the cone/cylinder intersection and at the previous locations of minimum shell thickness readings for each major component (top head, cylindrical wall, bottom cone and support skirt) on each of the four tanks.
- C. Conduct comprehensive ultrasonic thickness testing every 5 years for each major component (top head, cylindrical wall, bottom cone and support skirt) on each of tanks T-1, T-2, T-5, and T-6.
- D. Remove from service and repair or replace any tank with a cylindrical wall thickness that is less than or equal to 0.157 inches.
- E. Maintain paint coating on exterior surfaces of all tank system components that are carbon steel by repainting if visual observation indicates that 20% or greater of the components paint coating is damaged.
- F. Replace all carbon steel components and fittings of the tank system that are in direct contact with the spent carbon and recycle water slurry with 300 series stainless steel components and fittings prior to performing the next set of comprehensive ultrasonic thickness testing measurements.

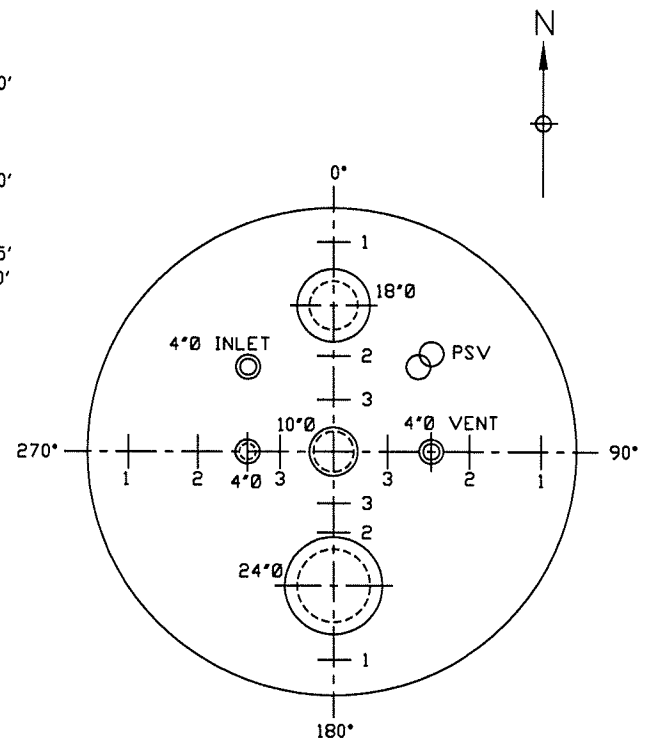
APPENDIX A

TANK DIAGRAMS AND ULTRASONIC TEST READINGS

TANK NO: T-1



SHELL ELEVATION



ROOF - TOP VIEW

TANK ELEVATION AND ORIENTATION FOR U/T READINGS
TANK T-1

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
JBE	10/24/11	KEM	10/24/11	KEM	10/24/11
SCALE	DWG. NO.	1541-SK-11001		REV.	0
1/4"=1'-0"					

NO	DWN	CK'D	APP	REVISIONS	DATE
CBE CHAVOND-BARRY ENGINEERING CORP.					
NJ Certificate of Authorization Number: 24GA27984700					
400 Route 518 • P.O. Box 205 • Blawenburg, New Jersey 08504					
SIEMENS INDUSTRY, INC.					
2523 MUTAHAR STREET					
PARKER, ARIZONA 85344					

Apr 17, 2012 - 2:55pm

SIEMENS INDUSTRY, INC.
PARKER, ARIZONA
TANK INSPECTION
CBE - February 2011

TANK NO: **T-1**
SERVICE: Spent Carbon Storage Tank
LOCATION: Outdoors on elevated structure,
NW quadrant of secondary containment

CYLINDRICAL SHELL U/T READINGS TAKEN OUTSIDE (INCHES)				
ELEV. (FT)	0° (North)	90° (East)	180° (South)	270° (West)
0.0	0.186	N/A	N/A	0.180
0.5	0.189	0.192	0.190	0.184
2.0	0.207	0.222	0.198	0.200
4.0	0.207	0.208	0.196	0.208
6.0	0.204	0.203	0.196	0.193
7.75	0.191	0.200	0.183	0.193
10.0	0.209	0.221	0.197	0.201
12.0	0.218	0.195	0.200	0.204
14.0	0.218	0.191	0.191	0.193
15.75	0.191	0.191	0.198	0.187
16.0	0.193	0.200	0.201	0.185

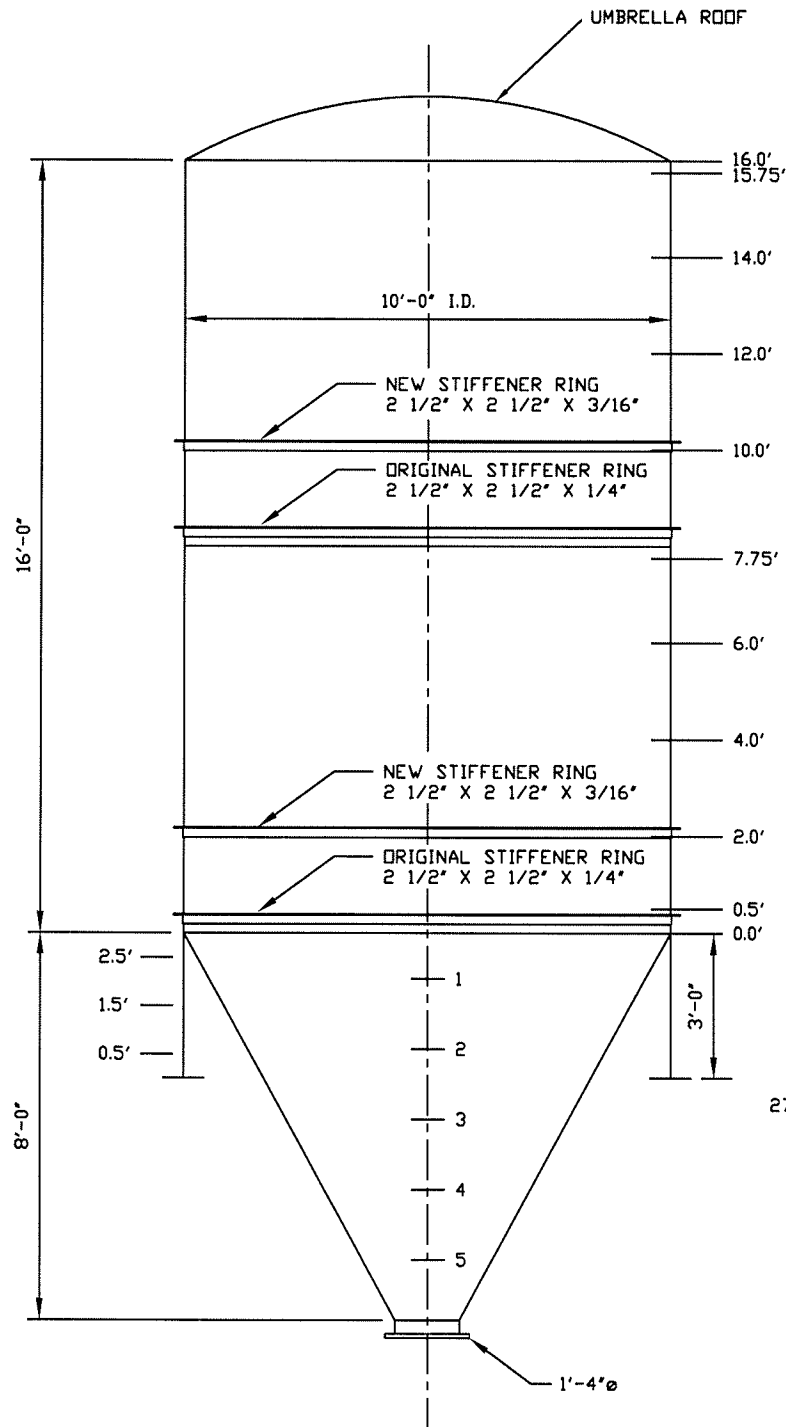
CONICAL BTM U/T READINGS TAKEN OUTSIDE (INCHES)				
LOCATION	0° (North)	90° (East)	180° (South)	270° (West)
1	0.190	0.200	0.194	0.197
2	0.195	0.196	0.194	0.194
3	0.190	0.204	0.196	0.200
4	.199/.189	0.192	0.192	0.189
5	0.188	0.193	0.195	0.186

TOP UMBRELLA ROOF HEAD U/T READINGS TAKEN OUTSIDE (INCHES)				
LOCATION	0° (North)	90° (East)	180° (South)	270° (West)
1	0.184	0.186	0.188	0.186
2	.187/.187	0.185	.186/.200	0.193
3	0.183	0.187	0.198	0.184

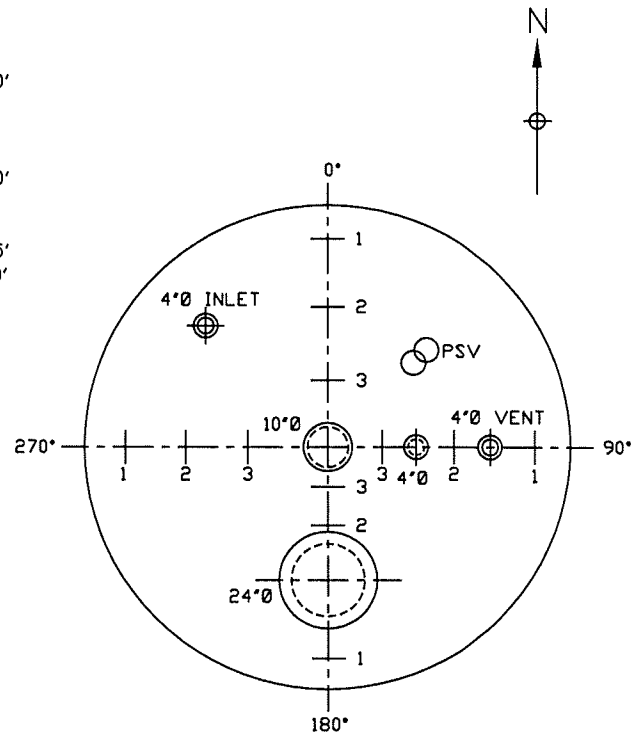
SKIRT U/T READINGS TAKEN OUTSIDE (INCHES)				
ELEV. (FT)	0° (North)	90° (East)	180° (South)	270° (West)
0.5	0.254	0.250	0.247	0.243
1.5	0.249	0.249	0.269	0.243
2.5	0.251	0.255	0.253	0.263

U/T = ULTRASONIC TESTING

TANK NO: T-2



SHELL ELEVATION



ROOF - TOP VIEW

TANK ELEVATION AND ORIENTATION FOR U/T READINGS
TANK T-2

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
JBE	10/24/11	KEM	10/24/11	KEM	10/24/11

SCALE
1/4"=1'-0"

DWG. NO.

1541-SK-11002

REV.
0

NO	DWN	CK'D	APP	REVISIONS	DATE
CBE CHAVOND-BARRY ENGINEERING CORP. NJ Certificate of Authorization Number: 24GA27984700 400 Route 518 • P.O. Box 205 • Blawenburg, New Jersey 08504					

SIEMENS INDUSTRY, INC.
2523 MUTAHAR STREET
PARKER, ARIZONA 85344

SIEMENS INDUSTRY, INC.
PARKER, ARIZONA
TANK INSPECTION
CBE - February 2011

TANK NO: T-2
SERVICE: Spent Carbon Storage Tank
LOCATION: Outdoors on elevated structure
NE quadrant of secondary containment

CYLINDRICAL SHELL U/T READINGS TAKEN OUTSIDE (INCHES)				
ELEV. (FT)	0° (North)	90° (East)	180° (South)	270° (West)
0.0	0.190	0.190	0.193	N/A
0.5	0.183	0.190	0.202	0.197
2.0	0.196	0.206	0.208	0.193
4.0	0.205	0.218	0.226	0.204
6.0	0.189	0.201	0.216	0.193
7.75	0.181	0.194	0.194	0.187
10.0	0.210	0.216	0.208	0.207
12.0	0.231	0.214	0.212	0.220
14.0	0.205	0.213	0.207	0.213
15.75	0.190	0.206	0.196	0.196
16.0	0.194	0.203	0.192	0.196

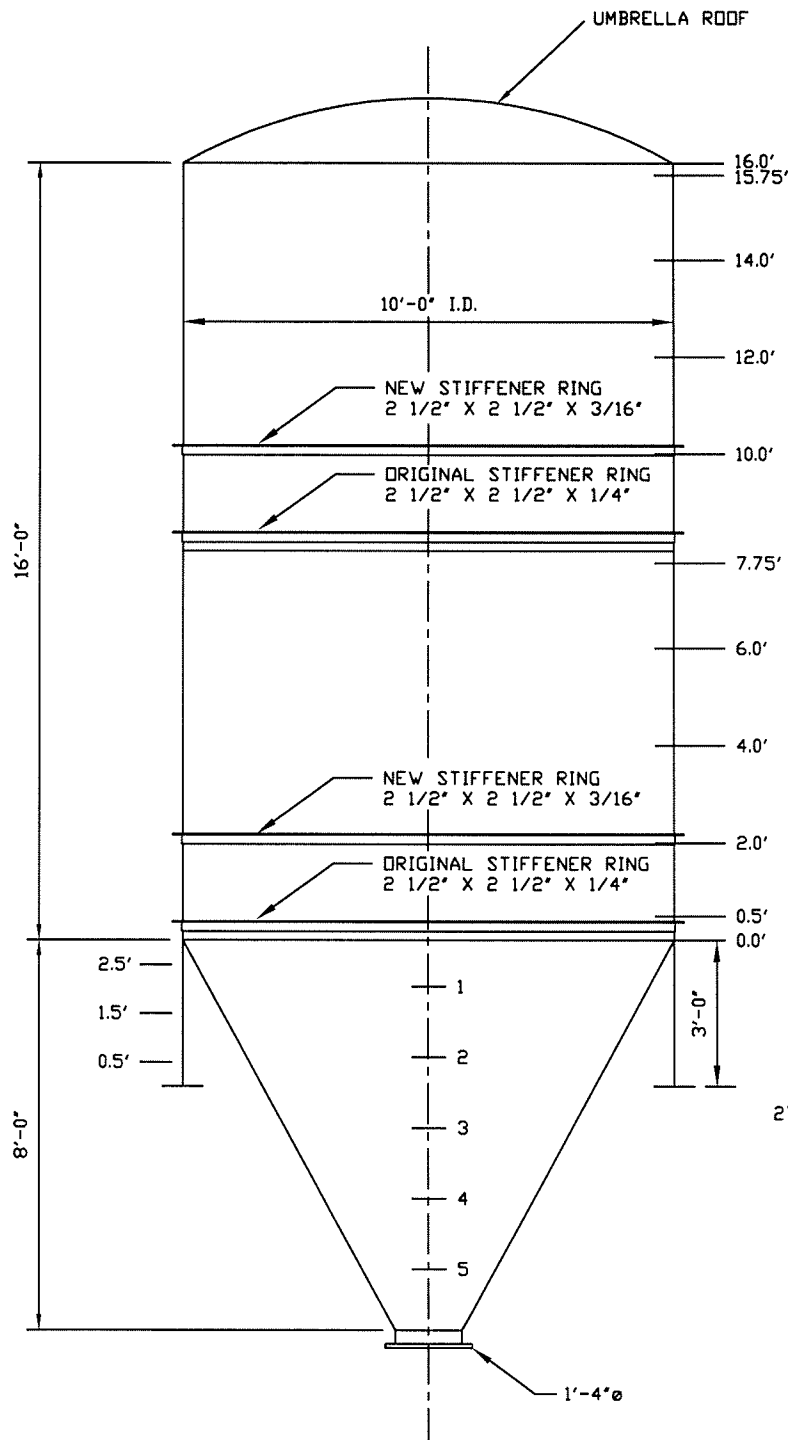
CONICAL BTM U/T READINGS TAKEN OUTSIDE (INCHES)				
LOCATION	0° (North)	90° (East)	180° (South)	270° (West)
1	0.201	0.202	0.208	0.191
2	.200/.192	0.205	0.203	0.192
3	0.199	0.197	0.203	0.190
4	0.202	0.196	0.196	0.190
5	0.196	0.197	0.204	0.192

TOP UMBRELLA ROOF HEAD U/T READINGS TAKEN OUTSIDE (INCHES)				
LOCATION	0° (North)	90° (East)	180° (South)	270° (West)
1	0.189	0.189	0.190	0.193
2	0.188	.197/.193	.188/.193	0.199
3	0.189	0.200	0.208	0.196

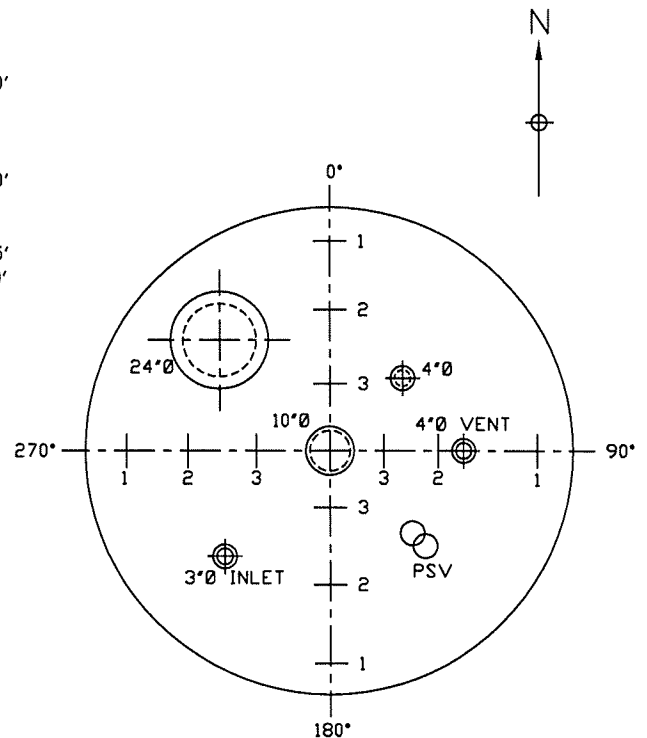
SKIRT U/T READINGS TAKEN OUTSIDE (INCHES)				
ELEV. (FT)	0° (North)	90° (East)	180° (South)	270° (West)
0.5	0.245	0.277	0.255	0.252
1.5	0.243	0.238	0.257	0.253
2.5	0.247	0.243	0.259	0.248

U/T = ULTRASONIC TESTING

TANK NO. T-5



SHELL ELEVATION



ROOF - TOP VIEW

TANK ELEVATION AND ORIENTATION FOR U/T READINGS
TANK T-5

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
JBE	10/24/11	KEM	10/24/11	KEM	10/24/11
SCALE	DWG. NO.	1541-SK-11003		REV.	0
1/4"=1'-0"					

NO	DWN	CK'D	APP	REVISIONS	DATE
CBE CHAVOND-BARRY ENGINEERING CORP.					
NJ Certificate of Authorization Number: 24GA27984700					
400 Route 518 • P.O. Box 205 • Blawenburg, New Jersey 08504					
SIEMENS INDUSTRY, INC.					
2523 MUTAHAR STREET					
PARKER, ARIZONA 85344					

Apr 17, 2012 - 10:59am

SIEMENS INDUSTRY, INC.
PARKER, ARIZONA
TANK INSPECTION
CBE - February 2011

TANK NO: **T-5**
SERVICE: Spent Carbon Storage Tank
LOCATION: Outdoors on elevated structure
SW quadrant of secondary containment

CYLINDRICAL SHELL U/T READINGS TAKEN OUTSIDE (INCHES)				
ELEV. (FT)	0° (North)	90° (East)	180° (South)	270° (West)
0.0	N/A	N/A	N/A	N/A
0.5	0.197	0.192	0.200	0.203
2.0	0.198	0.197	0.214	0.197
4.0	0.201	0.197	0.210	0.205
6.0	0.205	0.199	0.209	0.204
7.75	0.182	0.201	0.187	0.189
10.0	0.196	0.192	0.203	0.195
12.0	0.200	0.190	0.207	0.194
14.0	0.201	0.188	0.201	0.194
15.75	0.194	0.190	0.189	0.186
16.0	0.192	0.190	0.192	0.186

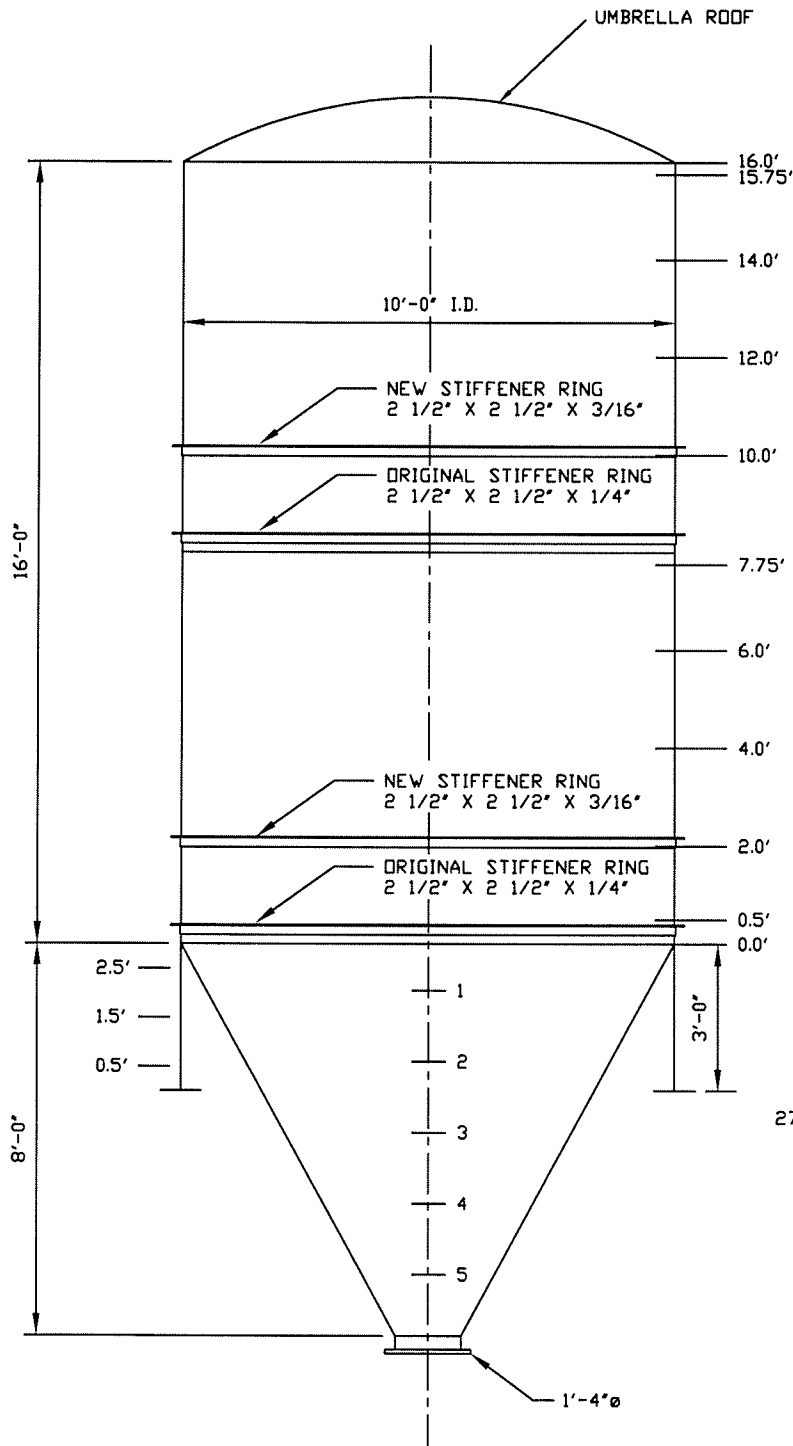
CONICAL BTM U/T READINGS TAKEN OUTSIDE (INCHES)				
LOCATION	0° (North)	90° (East)	180° (South)	270° (West)
1	0.191	0.191	0.167	0.186
2	0.192	0.190	0.181	0.190
3	0.188	0.192	0.180	0.184
4	0.186	0.190	0.182	0.188
5	0.185	0.185	0.183	0.188

TOP UMBRELLA ROOF HEAD U/T READINGS TAKEN OUTSIDE (INCHES)				
LOCATION	0° (North)	90° (East)	180° (South)	270° (West)
1	0.188	0.192	0.191	0.192
2	0.190	0.192	0.190	0.190
3	0.193	0.188	0.189	0.196

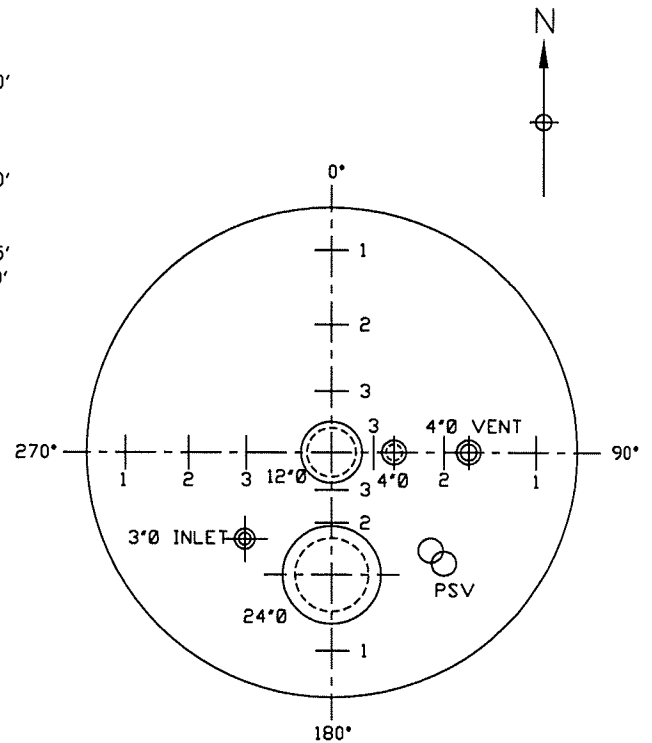
SKIRT U/T READINGS TAKEN OUTSIDE (INCHES)				
ELEV. (FT)	0° (North)	90° (East)	180° (South)	270° (West)
	2011	2011	2011	2011
0.5	0.237	0.253	0.260	0.256
1.5	0.240	0.251	0.257	0.255
2.5	0.237	0.253	0.255	0.251

U/T = ULTRASONIC TESTING

TANK NO. T-6



SHELL ELEVATION



ROOF - TOP VIEW

TANK ELEVATION AND ORIENTATION FOR U/T READINGS
TANK T-6

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
JBE	10/24/11	KEM	10/24/11	KEM	10/24/11
SCALE	DWG. NO.	REV.			
1/4"=1'-0"	1541-SK-11004	0			

NO	DWN	CK'D	APP	REVISIONS	DATE
CBE CHAVOND-BARRY ENGINEERING CORP.					
NJ Certificate of Authorization Number: 24GA27984700					
400 Route 518 • P.O. Box 205 • Blawenburgh, New Jersey 08504					

SIEMENS INDUSTRY, INC.
2523 MUTAHAR STREET
PARKER, ARIZONA 85344

SIEMENS INDUSTRY, INC.
PARKER, ARIZONA
TANK INSPECTION
CBE - February 2011

TANK NO: T-6
SERVICE: Spent Carbon Storage Tank
LOCATION: Outdoors on elevated structure
SE quadrant of secondary containment

CYLINDRICAL SHELL U/T READINGS TAKEN OUTSIDE (INCHES)				
ELEV. (FT)	0° (North)	90° (East)	180° (South)	270° (West)
0.0	0.208	0.222	N/A	N/A
0.5	0.192	0.180	0.197	0.195
2.0	0.206	0.193	0.200	0.200
4.0	0.202	0.202	0.199	0.208
6.0	0.202	0.194	0.196	0.208
7.75	0.196	0.189	0.200	0.198
10.0	0.194	0.198	0.199	0.199
12.0	0.210	0.204	0.212	0.203
14.0	0.202	0.202	0.210	0.200
15.75	0.182	0.184	0.202	0.196
16.0	0.178	0.176	0.195	0.202

CONICAL BTM U/T READINGS TAKEN OUTSIDE (INCHES)**				
LOCATION	0° (North)	90° (East)	180° (South)	270° (West)
	2011	2011	2011	2011
1	0.198	0.195	0.212	0.191
2	0.382	0.380	0.383	0.381
3	0.383	0.386	0.386	0.379
4	0.384	0.400	0.380	0.382
5	0.386	0.399	0.380	0.377

TOP UMBRELLA ROOF HEAD U/T READINGS TAKEN OUTSIDE (INCHES)				
LOCATION	0° (North)	90° (East)	180° (South)	270° (West)
	2011	2011	2011	2011
1	0.189	0.191	0.187	0.187
2	0.190	0.222	.193/.189	0.187
3	0.190	0.191	0.193	0.187

SKIRT U/T READINGS TAKEN OUTSIDE (INCHES)				
ELEV. (FT)	0° (North)	90° (East)	180° (South)	270° (West)
	2011	2011	2011	2011
0.5	0.260	0.255	0.246	0.251
1.5	0.258	0.260	0.245	0.249
2.5	0.249	0.251	0.247	0.250

U/T = ULTRASONIC TESTING

** = "new" bottom cone (locations 2-5)

NDT

NDT INTERNATIONAL, INC.

711 S. CREEK ROAD
WEST CHESTER, PA 19382

Tel: 610.793.1700 Fax: 610.793.1702
E-mail: info@ndtint.com

CERTIFICATE of CALIBRATION

Certificate No. UT-0217-11

Customer: Chavond-Barry Engineering Corporation
400 County Road 518
Blawenburg, NJ 08504

Order No. Universal Technical Equipment, Inc.

Instrument: Model NDT-715 Ultrasonic Thickness Gauge, Serial No. 733351

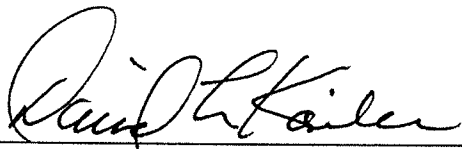
This instrument has been checked and calibrated in accordance with our operational verification procedure NDT-715-STD using the standard 1/4" diameter 5.0 MHz dual element transducer (P/N T-102-2000) provided with this gauge. This instrument meets all range and accuracy requirements (± 0.002 " from 0.040" to 1.000" and $\pm 1\%$ greater than 1.000"). An annual calibration cycle is recommended.

Equipment and standards referenced are maintained in accordance with our written procedure controlling measuring and test equipment and to provide traceability to NIST standards.

Steel thickness reference blocks used in this calibration were Serial Numbers 6997, A02295 and 95-6046.

Date of Calibration: February 17, 2011

Verified by:



David L. Kailer, Quality Assurance Manager

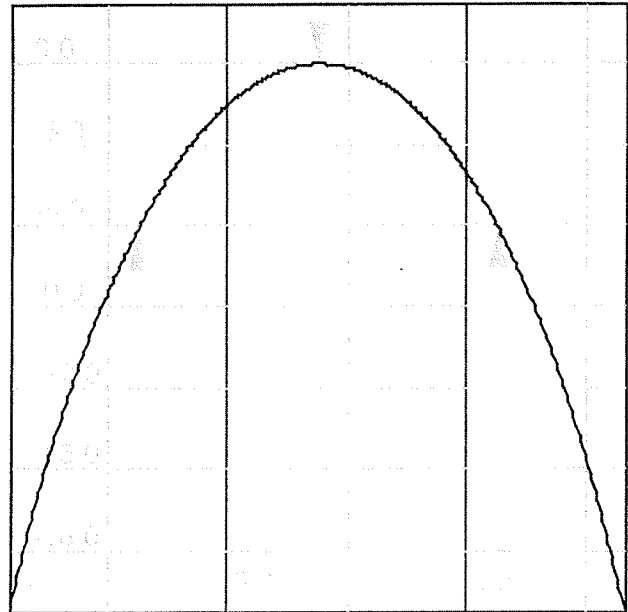
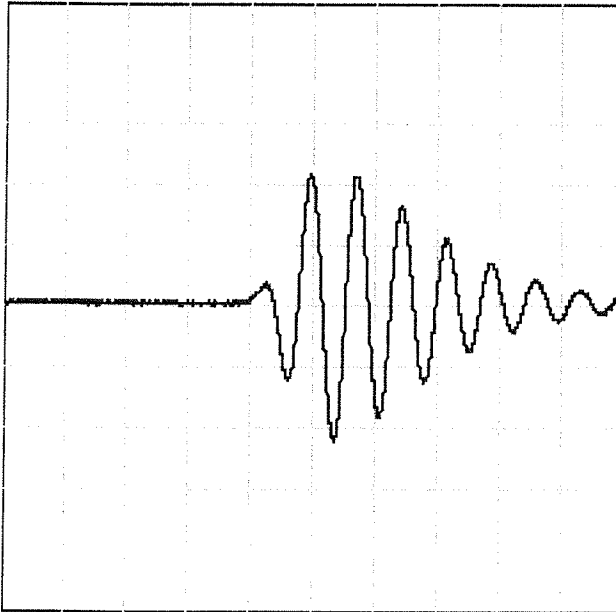
<u>Actual Thickness</u>	<u>Measured Thickness</u>
0.040"	0.042"
0.100"	0.099"
0.200"	0.198"
0.250"	0.250"
0.300"	0.300"
0.400"	0.400"
0.500"	0.500"
0.750"	0.751"
1.000"	1.000"
2.000"	2.004"
4.000"	4.023"
6.000"	6.026"

Next calibration is due by February 17, 2012

NOTE: NDT International's Quality program meets the requirements of MIL-STD-45662A.

Dakota Ultrasonics

Transducer Performance Documentation



Transducer Details

Part Number: T-102-2000
Serial Number: AG766
Class/Type: SIDP
Nominal Freq: 5 MHz
Diameter(in): 0.250"
Connector Type: LEMO 00

Test Conditions

Tester Initials: CD
Date: Aug 11, 2010
Test Target: 1.00"
Test Material: 4340 steel
Cable Type: 4' Potted

Measurement Results

Peak Frequency(MHz): 5.4 MHz
-6 dB Bandwidth 1.5 MHz
-6 dB Lo(MHz) 4.6 MHz
-6 dB Hi(MHz) 6.1 MHz
Volts/Div: 500.0 mv
Time/Div: 250.0 ns

Pulser/Receiver Settings

Manufacturer: Panametrics
Model/Serial: 500PR / 281
Damping: 0
Pulse Height: high
High Pass Filter: in
Gain: 45dB

APPENDIX B

HAZARDOUS WASTE CHARACTERISTICS

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
D001	A SOLID WASTE THAT EXHIBITS THE CHARACTERISTIC OF IGNITABILITY
D004	ARSENIC
D005	BARIUM
D006	CADMIUM
D007	CHROMIUM
D008	LEAD
D009	MERCURY
D010	SELENIUM
D011	SILVER
D012	ENDRIN
D013	LINDANE
D014	METHOXYCHLOR
D015	TOXAPHENE
D016	2,4-D
D017	2,4,5-(SILVEX)
D018	BENZENE
D019	CARBON TETRACHLORIDE
D020	CHLORDANE
D021	CHLOROBENZENE
D022	CHLOROFORM
D023	O-CRESOL
D024	M-CRESOL
D025	P-CRESOL
D026	CRESOL
D027	1,4-DICHLOROBENZENE
D028	1,2-DICHLOROETHANE
D029	1,1-DICHLOROETHYLENE
D030	2,4-DITROTOLUENE
D031	HEPTACHLOR (AND ITS EPOXIDE)
D032	HEXACHLOROBENZENE
D033	HEXACHLOROBUTADIENE
D034	HEXACHLOROETHANE
D035	METHYL ETHYL KETONE
D036	NITROBENZENE
D037	PENTRACHLOROPHENOL

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
D038	PYRIDINE
D039	TETRACHLOROETHYLENE
D040	TRICHLOROETHYLENE
D041	2,4,5-TRICHLOROPHENOL
D042	2,4,6-TRICHLOROPHENOL
D043	VINYL CHLORIDE
F001	SPENT HALOGENATED SOLVENTS USED IN DEGREASING: TETRACHLOROETHYLENE, TRICHLOROETHYLENE, METHYLENE CHLORIDE, 1,1,1-TRICHLOROETHANE, CARBON TETRACHLORIDE, CHLORINATED FLUOROCARBONS; AND MIXTURES/BLENDS CONTAINING A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) BEFORE USE OF ONE OR MORE OF THE ABOVE SOLVENTS OR SOLVENTS LISTED IN F002, F004 AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF SPENT SOLVENTS AND MIXTURES
F002	TETRACHLOROETHYLENE, METHYLENE CHLORIDE, TRICHLOROETHYLENE, 1,1,1-TRICHLOROETHANE, CHLOROBENZENE, 1,1,2-TRICHLOROETHANE; AND MIXTURES/BLENDS CONTAINING A TOTAL OF 10% OR MORE (BY VOLUME) BEFORE USE OF ONE OR MORE OF THE ABOVE SOLVENTS OR SOLVENTS LISTED IN F002, F004 AND F005 AND STILL BOTTOMS FROM RECOVERY OF SPENT SOLVENTS AND MIXTURES
F003	XYLENE, ACETONE ETHYL ACETATE, ETHYL BENZENE, ETHYL ETHER, METHYL ISOBUTYL KETONE, N-BUTYL ALCOHOL, CYCLOHEXANANE, METHANOL; MIXTURES/BLENDS OF ABOVE; AND 10% OR MORE (BY VOLUME) OF F001, F002, F004, F005; AND STILL BOTTOMS FROM RECOVERY OF SPENT SOLVENTS
F004	CRESOLS AND CRESYLIC ACID, NOTROBENZENE; SOLVENT MIXTURES/BLENDS OF 10% OR MORE BEFORE USE OF ONE OR MORE OF ABOVE OR F001, F002, F005; STILL BOTTOMS FROM RECOVERY OF SPENT SOLVENTS
F005	TOLUENE, METHYL ETHYL KETONE, CARBON DISULFIDE, ISOBUTANOL, PYRIDINE, BENZENE, 2-ETHOXYETHANOL, 2-NITROPROPANE; MIXTURES/BLENDS OF 10% OR MORE (BY VOLUME) OF ABOVE OR SOLVENTS LISTED IN F001, F002, F004 AND STILL BOTTOMS FROM RECOVERY OF SOLVENTS
F006	WASTEWATER TREATMENT SLUDGES FROM ELECTROPLATING OPERATIONS EXCEPT FROM SULFURIC ACID ANODIZING OF ALUMINUM; TIN PLATING ON CARBON STEEL; ZINC PLATING ON CARBON STEEL; ALUMINUM, ZINC ALUMINUM PLATING ON CARBON STEEL; CLEANING/STRIPPING ASSOCIATED WITH TIN, ZINC AND ALUMINUM PLATING ON CARBON STEEL; AND CHEMICAL ETCHING AND MILLING OF ALUMINUM
F012	QUENCHING WASTEWATER TREATMENT SLUDGES FROM METAL HEAT TREATING OPERATIONS WHERE CYANIDES ARE USED
F019	WASTEWATER TREATMENT SLUDGES FROM CHEMICAL CONVERSION COATING OF ALUMINUM EXCEPT ZIRCONIUM PHOSPHATING IN ALUMINUM CAN WASHING

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
F025	CONDENSED LIGHT ENDS, SPENT FILTERS AND AIDS, SPENT DESICCANT WASTES FROM PRODUCTION OF CERTAIN CHLORINATED ALIPHATIC HYDROCARBONS (HAVING CARBON CHAIN LENGTHS RANGING FROM 1-5 WITH VARYING AMOUNTS AND POSITIONS OF CHLORINE SUBSTITUTION) BY FREE RADICAL CATALYZED PROCESSES.
F035	WASTEWATERS, PROCESS RESIDUALS, PRESERVATIVE DRIPPAGE, AND SPENT FORMULATIONS FORM WOOD PRESERVING PROCESS GENERATED AT PLANTS THAT USE INORGANIC PRESERVATIVES CONTAINING ARSENIC OR CHROMIUM. DOES NOT INCLUDE K001 BOTTOM SEDIMENT SLUDGE FROM TREATMENT OF WASTEWATER FROM WOOD PRESERVING PROCESSES USING CREOSOTE AND/OR PENTACHLOROPHENOL
F037	PETROLEUM REFINERY PRIMARY OIL/WATER/SOLIDS SEPARATION SLUDGE. SLUDGE FROM GRAVITATIONAL SEPARATION OF OIL/WATER/SOLIDS DURING STORAGE OR TREATMENT OF PROCESS WASTEWATERS AND OILY COOLING WASTEWATERS FROM PETROLEUM REFINERIES. (OIL/WATER/SOLIDS SEPARATORS; TANKS AND IMPOUNDMENTS; DITCHES/CONVEYANCES; SUMPS; STORMWATER UNITS. SLUDGES FROM NON-CONTACT ONCE-THROUGH COOLING WATERS, SLUDG3ES FROM AGRESSIVE BIOLOGICAL TREATMENT UNITS, K051 WASTES
F038	PETROLEUM REFINERY SECONDARY (EMULSIFIED) OIL/WATER/SOLIDS SEPARATION SLUDGE-ANY SLUDGE AND/OR FLOAT GENERATED FROM THE PHYSICAL AND/OR CHEMICAL SEPARATION OF OIL/WATER/SOLIDS IN PROCESS WASTEWATERS AND OILY COOLING WASTEWATERS FROM PETROLEUM REFINERIES. SUCH WASTES INCLUDE, BUT ARE NOT LLIMITED TO, ALL SLUDGES AND FLOATS GENERATED IN: INDUCED AIR FLOTATION (IAF) UNITS, TANKS AND IMPOUNDMENTS, AND ALL SLUDGES GENERATED IN DAF UNITS. SLUDGES GENERATED IN STORMWATER UNITS THAT DO NBOT RECEIVE DRY WEATHER FLOW, SLUDGES GENERATED FROM NON-CONTACT ONCE-THROUGH COOLING WATERS SEGREGATED FOR TREATMENT FROM OTHER PROCESS OR OILY COOLING WATERS, SLUDGES AND FLOATS GENERATED IN AGRESSIVE BIOLOGICAL TREATMENT UNITS (INCLUDING SLUDGES AND FLOATS GENERATED IN ONE OR MORE ADDITIONAL UNITS AFTER WASTEWATERS HAVE BEEN TREATED IN AGGRESSIVE GIOLOGICAL TREATMENT UNITS) AND F037,K048, AND K051 WASTES ARE NOT INCLUDED IN THIS LISTING.
F039	LEACHATE FROM DISPOSAL OF MORE THAN ONE RESTRICTED WASTE (HAZARDOUS UNDER SUBPART D; RESULTING FROM THE DISPOSAL OF ONE OR MORE OF EPA HAZARDOUS WASTES: F020, F021, F022, F026, F027, AND/OR F028)
K001	WASTEWATER TREATMENT SLUDGE BOTTOM SEDIMENT THAT USE CREOSOTE AND/OR PENTACHLOROPHENOL
K002	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF CHROME YELLOW AND ORANGE PIGMENTS
K003	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF MOLYBDATE ORANGE PIGMENTS
K004	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF ZINC YELLOW PIGMENTS

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
K005	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF CHROME GREEN PIGMENTS
K006	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF CHROME OXIDE GREEN PIGMENTS (ANHYDROUS AND HYDRATED)
K007	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF IRON BLUE PIGMENTS
K008	OVEN RESIDUE FROM PRODUCTION OF CHROME OXIDE GREEN PIGMENTS
K009	DISTILLATION BOTTOMS FROM THE PRODUCTION OF ACETALDEHYDE FROM ETHYLENE
K010	DISTILLATION SIDE CUTS FROM PRODUCTION OF ACETALDEHYDE FROM ETHYLENE
K014	VICINALS FROM THE PURIFICATION OF TOLUENEDIAMINE IN THE PRODUCTION OF TOLUENEDIAMINE VIA THE HYDROGENATION OF DINITROTOLUENE
K015	STILL BOTTOMS FROM DISTILLATION OF BENZYL CHLORIDE
K016	HEAVY ENDS OR DISTILLATION RESIDUES FROM PRODUCTION OF CARBON TETRACHLORIDE
K017	HEAVY ENDS (STILL BOTTOMS) FROM PURIFICATION COLUMN IN PRODUCTION OF EPICHLOROHYDRIN
K018	HEAVY ENDS FROM FRACTIONATION COLUMN IN ETHYL CHLORIDE PRODUCTION
K019	HEAVY ENDS FORM THE DISTILLATION OF ETHYLENE DICHLORIDE IN ETHYLENE DICHLORIDE PRODUCTION
K020	HEAVY ENDS FROM DISTILLATION OF VINYL CHLORIDE IN VINYL CHLORIDE MONOMER PRODUCTION
K022	DISTILLATION BOTTOM TARS FROM PRODUCTION OF PHENOL/ACETONE FROM CUMENE
K023	DISTILLATION LIGHT ENDS FROM PRODUCTION OF PHTHALIC ANHYDRIDE FROM NAPHTHALENE
K024	DISTILLATION BOTTOMS FROM PRODUCTION OF PHTHALIC ANHYDRIDE FROM NAPHTHALENE
K025	DISTILLATION BOTTOMS FROM THE PRODUCTION OF NITROBENZENE BY THE NITRATION OF BENZENE
K026	STRIPPING STILL TAILS FROM PRODUCTION OF METHY ETHYL PYRIDINES
K029	WASTE FROM PRODUCT STEAM STRIPPER IN PRODUCTION OF 1,1,1-TRICHLOROETHANE
K030	COLUMN BOTTOMS OR HEAVY ENDS FROM COMBINED PRODUCTION OF TRICHLOROETHYLENE AND PERCHLOROETHYLENE
K031	BY-PRODUCT SALTS GENERATED IN PRODUCTION OF MSMA AND CACODYLIC ACID
K032	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF CHLORDANE
K033	WASTEWATER TREATMENT AND SCRUB WATER FROM CHLORINATION OF CYCLOPENTADIENE IN PRODUCTION OF CHLORDANE

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
K034	FILTER SOLIDS FROM FILTRATION OF HEXACHLOROCYCLOPENTADIENE IN PRODUCTION OF CHLORDANE
K035	WASTEWATER TREATMENT SLUDGES GENERATED IN PRODUCTION OF CREOSOTE
K036	STILL BOTTOMS FROM TOLUENE RECLAMATION DISTILLATION IN PRODUCTION OF DISULFOTON
K037	WASTEWATER TREATMENT SLUDGES FROM PRODUCTION DISULFOTON
K038	WASTEWATER FROM WASHING AND STRIPPING OF PHORATE PRODUCTION
K039	FILTER CAKE FROM FILTRATIN OF DIETHYLPHOSPHORODITHIOIC ACID IN PRODUCTION OF PHORATE
K040	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF PHORATE
K041	WASTEWATER TREATMENT SLUDGE FORM PRODUCTION OF TOXAPHENE
K042	HEAVY ENDS OR DISTILLATION RESIDUES FROM DISTILLATION OF TETRACHLOROBENZENE IN PRODUCTION OF 2,4,5-T
K046	WASTEWATER TREATMENT SLUDGES FROM THE MANUFACTURING, FORMULATION AND LOADING OF LEAD-BASED INTIATING COMPOUNDS.
K048	DISSOLVED AIR FLOTATION FLOAT FROM PETROLEUM REFINING INDUSTRY
K049	SLOP OIL EMULSION SOLIDS FROM PETROLEUM REFINING INDUSTRY
K050	HEAT EXCHANGER BUNDLE CLEANING SLUDGE FROM PETROLEUM REFINING INDUSTRY
K051	API SEPARATOR SLUDGE FROM PETROLEUM REFINING INDUSTRY
K052	TANK BOTTOMS (LEADED) FROM PETROLEUM REFINING INDUSTRY
K061	EMISSION CONTROL DUST/SLUDGE FROM PRIMARY PRODUCTION OF STEEL IN ELECTRIC FURNACES
K064	ACID PLANT BLOWDOWN SLURRY/SLUDGE RESULTING FROM THE THICKENING OF BLOWDOWN SLURRY FROM PRIMARY COPPER PRODUCTION
K065	SURFACE IMPOUNDMENT SOLIDS CONTAINED IN AND DREDGED FROM SURFACE IMPOUNDMENTS AT PRIMARY LEAD SMELTING FACILITIES.
K066	SLUDGE FROM TREATMENT OF PROCESS WASTEWATER AND/OR ACID PLANT BLOWDOWN FROM PRIMARY ZINC PRODUCTION
K071	BRINE PURIFICATION MUDS FROM MERCURY CELL PROCESS IN CHLORINE PRODUCTION WHERE SEPARATELY PREPURIFIED BRINE IS NOT USED
K073	CHLORINATED HYDROCARBON WASTE FROM PURIFICAITON STEP OF THE DIAPHRAGM CELL PROCESS USING GRAPHITE ANODES IN CHLORINE PRODUCTION
K083	DISTILLATION BOTTOMS FROM ANILINE PRODUCTION
K084	WASTEWATER TREATMENT SLUDGES GENERATED DURING PRODUCTION OF VETERINARY PHARMACEUTICALS FROM ARSENIC OR ORGANO-ARSENIC COMPOUNDS
K085	DISTILLATION OR FRACTIONATION COLUMN BOTTOMS FROM PRODUCTION OF CHLOROBENZENES

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
K086	SOLVENT WASHES AND SLUDGES, CAUSTIC WASHES AND SLUDGES, OR WATER WASHES AND SLUDGES FROM CLEANING TUBS AND EQUIPMENT USED IN FORMULATION OF INK FROM PIGMENTS, DRIERS, SOAPS, STABILIZERS CONTAINING CHROMIUM AND LEAD
K087	DECANTER TANK TAR SLUGE FROM COKING
K088	SPENT POTLINERS FROM PRIMARY ALUMINUM REDUCTION
K090	EMISSION CONTROL DUST OR SLUDGE FROM FERROCHROMIUMSILICON PRODUCTION
K091	EMISSION CONTROL DUST OR SLUDGE FROM FERROCHROMIUM PRODUCTION
K093	DISTILLAION LIGHT ENDS FROM PRODUCTION OF PHTHALIC ANHYDRIDE FROM ORTHO-XYLENE
K094	DISTILLATION BOTTOMS FROM PRODUCTION OF PHTHALIC ANHYDRIDE FROM ORTHO-XYLENE
K095	DISTILLAION BOTTOMS FROM PRODUCTION OF 1,1,1-TRICHLOROETHANE
K096	HEAVY ENDS FROM HEAVY ENDS COLUMN FROM PRODUCTION OF 1,1,1-TRICHLOROETHANE
K097	VACUUM STRIPPER DISCHARGE FROM CHLORDANE CHLORINATOR IN PRODUCTION OF CHLORDANE
K098	UNTREATED PROCESS WASTEWATER FROM PRODUCTION OF TOXAPHENE
K100	WASTE LEACHING SOLUTION FROM ACID LEACHING OF EMISSION CONTROL DUST/SLUDGE FROM SECONDARY LEAD SMELTING
K101	DISTILLATION TAR RESIDUES FROM DISTILLATIONOF ANILINE-BASED COMPOUNDS IN PRODUCTION OF VETERINARY PHARMACEUTICALS FROM ARSENIC OR ORGANO-ARSENIC COMPOUNDS
K102	RESIDUE FROM USE OF ACTIVATED CARBON FOR DECOLORIZATION IN PRODUCTION OF VETERINARY PHARMACEUTICALS FRO ARSENIC OR ORGANO-ARSENIC COMPOUNDS
K103	PROCESS RESIDUES FROM ANILINE EXTRACTION FROM PRODUCTIONOF ANILINE
K104	COMBINED WASTEWATER STREAMS GENERATED FROM NITROBENZENE/ANILINE PRODUCTION
K105	SEPARATED AQUEOUS STREAM FROM THE REACTOR PRODUCT WASHING STEP IN PRODUCTION OF CHLOROBENZENES
K106	WASTEWATER TREATMENT SLUDGE FROM MERCURY CELL PROCESS IN CHLORINE PRODUCTION
K112	REACTION BY-PRODUCT WATER FROM THE DRYING COLUMN IN PRODUCTION OF TOLUENEDIAMINE VIA HYDROGENATION OF DINITROTOLUENE
K113	CONDENSED LIQUID LIGHT ENDS FROM THE PURIFICATIONOF TOLUENEDIAMINE IN PRODUCTION OF TOLUENEDIAMINE VIA HYDROGENATION OF DINITROTOLUENE
K114	VICINALS FROM PURIFICAITON OF TOLUENEDIAMINE IN PRODUCTION OF TOLUENEDIAMINE VIA HYDROGENATION OF DINITROTOLUENE

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
K115	HEAVY ENDS FROM THE PURIFICATION OF TOLUENEDIAMINE IN PRODUCTION OF TOLUENEDIAMINE VIA HYDROGENATION OF DINITROTOLUENE
K116	ORGANIC CONDENSATE FROM SOLVENT RECOVERY COLUMN IN PRODUCTION OF TOLUENE DIISOCYANATE VIA PHOSGENATION OF TOLUENEDIAMINE
K117	WASTEWATER FROM THE REACTOR VENT GAS SCRUBBER IN PRODUCTION OF ETHYLENE DIBROMIDE VIA BROMINATION OF ETHENE
K118	SPENT ADSORBENT SOLIDS FROM PURIFICATION OF ETHYLENE DIBROMIDE IN PRODUCTION OF ETHYLENE DIBROMIDE VIA BROMINATION OF ETHENE
K125	FILTRATION, EVAPORATION, AND CENTRIFUGATION SOLIDS FROM THE PRODUCTION OF ETHYLENEBISDITHIOCARBAMIC ACID AND ITS SALTS.
K126	BAGHOUSE DUST AND FLOOR SWEEPINGS IN MILLING AND PACKAGING OPERATIONS FROM PRODUCTION OR FORMULATION OF ETHYLENE BIS DITHIOCARBAMIC ACID AND ITS SALTS
P001	2H-1-BENZOPYRAN-2-ONE, 4-HYDROXY-3-(3-OXO-1-PHENYLBUTYL)-, & SALTS, WHEN PRESENT AT CONCENTRATIONS GREATER THAN 0.3% WARFARIN, & SALTS, WHEN PRESENT AT CONCENTRAIONS GREATER THAN 0.3%
P002	ACETAMINE, N-(AMINOTHIOXOMETHYL); Also known as 1-ACETYL-2-THIOUREA
P003	ACROLEIN; Also known as 2-PROPENAL
P004	ALDRIN; Also known as 1,4,5,8-DIMETHANONAPHTHALENE, 1,2,3,4,10,10-HEXA-CHLORO-1,4,4A,5,8,8A,-HEXAHYDRO, (ALPHA, 4ALPHA, 4 ABETA, 5 ALPHA, 8ALPHA, 8ABETA)-
P005	ALLYL ALCOHOL; Also known as 2-PROPEN-1-OL
P007	5-(AMINOMETHYL)-3-ISOXAZOLOL; Also known as 3(2H)-ISOXAZOLONE, 5-(AMINOMETHYL)-
P008	4-AMINOPYRIDINE; Also known as 4-PYRIDINAMINE
P010	ARSENIC ACID H_3AsO_4
P011	ARSENIC OXIDE As_2O_5 ; Also known as ARSENIC PENTOXIDE
P012	ARSENIC OXIDE As_2O_3 ; Also known as ARSENIC TRIOXIDE
P013	BARIUM CYANIDE
P014	BENZENETHIOL; Also known as THIOPHENOL
P015	BERYLLIUM
P016	DICHLOROMETHYL ETHER; Also known as METHANE, OXYBIS[CHLORO-
P017	BROMOACETONE; Also known as 2-PROPANONE, 1-BROMO-
P018	BRUCINE
P020	DIOSEB; Also known as PHENOL, 2-(1-METHYLPROPYL)-4,6-DINITRO-
P021	CALCIUM CYANIDE; Also known as CALCIUM CYANIDE $Ca(CN)_2$
P022	CARBON DISULFIDE
P023	ACETALDEHYDE, CHLORO-; Also known as CHLOROACETALDEHYDE
P024	BENZENAMINE, 4-CHLORO-; Also known as P-CHLORANILINE

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
P026	1-(O-CHLOROPHENYL)THIOUREA; Also known as THIOUREA, (2-CHLOROPHENYL)-
P027	PROPANENITRILE, 3-CHLORO-; Also known as 3-CHLOROPROPIONITRILE
P028	BENZENE, (CHLOROMETHYL)-; Also known as BENZYL CHLORIDE
P029	COPPER CYANIDE; Also known as COPPER CYANIDE CU(CN)
P030	CYANIDES (SOLUBLE CYANIDE SALTS), NOT OTHERWISE SPECIFIED
P031	CYANOGEN; Also known as ETHANEDINITRILE
P033	CYANOGEN CHLORIDE; Also known as CYANOGEN CHLORIDE (CN)CL
P034	2-CYCLOHEXYL-4,6-DINITROPHENOL; Also known as PHENOL, 2-CYCLOHEXYL-4,6-DINITRO-
P036	ARSONOUS DICHLORIDE, PHENYL-; Also known as DICHLOROPHENYLARSINE
P037	DIELDRIN; Also known as 2,7:3,6-DIMETHANONAPHTH[2,3-B]OXIRENE, 3,4,5,6,9,9-HEXACHLORO-1A,2,2A,3,6,6A,7,7A-OCTAHYDRO-, (1AALPHA, 2BETS, 2AALPHA, 3BETAK, 6BETA, 6AALPHA, 7BETA, 7AALPHA)-
P038	ARSINE, DIETHYL-; Also known as DIETHYLARSINE
P039	PHOSPHORODITHIOIC ACID, O,O-DIETHYL S-[2-(ETHYLTHIO)ETHYL]ESTER; Also known as DISULFOTON
P040	O,O-DIETHYL O-PYRAZINYL PHOSPHOROTHIOATE; Also known as PHOSPHOROTHIOIC ACID, O, O-DIMETHYL O-(4 NITROPHENYL) ESTER
P041	PHOSPHORIC ACID, DIETHYL 4-NITROPHENYL ESTER; Also known as DIETHYL-P-NITROPHENYL PHOSPHATE
P042	1,2-BENZENEDIOL, 4-[HYDROXY-2-(METHYLAMINO)ETHYL]-,(R)-; Also known as EPINEPHRINE
P043	DIISOPROPYLFLUOROPHOSPHATE (DFP); Also known as PHOSPHOROFLUORIDIC ACID, BIS (1-METHYLETHYL)ESTER
P044	DIMETHOATE; Also known as PHOSPHORODITHIOIC ACID,O, O-DIMETHYL S-[2-(METHYLAMINO)-2-OXOETHYL]ESTER
P045	2-BUTANONE, 3, 3-DIMETHYL-1-(METHYITHIO)-,O-[METHYLOAMINO)CARBONYL]OXIME; Also known as THIOFANOX
P046	BENZENEETHANAMINE, ALPHA,ALPHA-DIMETHYL-; Also known as ALPHA,ALPHA-DIMETHYLPHENETHYLAMINE
P047	4,6-DINITRO-O-CRESOL, & SALTS; Also known as PHENOL,2-METHYL-4,6-DINITRO-, & SALTS
P048	2,4-DINITROPHENOL; Also known as PHENOL, 2,4-DINITRO-
P049	DITHIOBIURET; Also known as THIOIMIDODICARBONIC DIAMIDE [H ₂ N)C(S)] ₂ NH
P050	ENDOSULFAN; Also known as 6M9-METHANO-2,4,3-BENZODIOXATHIEPIN, 6,7,8,9,10,1K0-HEXACHLORO-1,5,5A,6,9,91-HEXAHYDRO-,3-OXIDE

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
P051	2,7:3,6-DIMETHANONAPHTH [2,3-B]OXIRENE, 3,4,5,6,9,9-HEXACHLORO-1A,2,2A,3,6,6A,7,7A-OCTAHYDRO-, (1AALPHA, 2BETA, 2ABETA, 3ALPHA, 6ALPHA, 6ABETA, 7BETA, 7AALPHA)-, & METABOLITES; Also known as ENDRIN; Also known as ENDRIN, & METABOLITES
P054	AZIRIDINE; Also known as ETHYLENEIMINE
P056	FLUORINE
P057	ACETAMIDE, 2-FLUORO-; Also known as FLUOROACETAMIDE
P058	ACETIC ACID, FLUORO-,SODIUM SALT; Also known as FLUOROACETIC ACIDE, SODIUM SALT
P059	HEPTACHLOR; Also known as 4,7-METHANO-1H-INDENE, 1,4,5,6,7,8,-HEPTACHLORO-3A,4,7,7A-TETRAHYDRO-
P060	1,4,5,8-DIMETHANONAPHTHALENE,1,2,3,4,10,10-HEXA- CHLORO-1,4,4A,5,7,8,8A-HEXAHYDRO-(1ALPHA, 4ALPHA, 4ABETA, 5BETA,8BETA,8ABETA)-; Also known as ISODRIN
P062	HEXAETHYL TETRAPHOSPHATE; Also known as TETRAPHOSPHORIC ACID, HEXAETHYL ESTER
P063	HYDROCYANIC ACID; Also known as HYDROGEN CYANIDE
P064	METHANE, ISOCYANATO-
P066	ETHANIMIDOTHIOIC ACID, N-[[[(METHYLAMINO)CARBONYL]OXY]-, METHYL ESTER; Also known as METHOMYL
P067	AZINIDINE, 2-METHYL; Also known as 1,2-PROPYLENIMINE
P068	HYDRAZINE, METHYL-; Also known as METHYL HYDRAZINE
P069	2-METHYLLACTONITRILE; Also known as PROPANENITRILE, 2-HYDROXY-2-METHYL-
P070	ALDICARB; Also known as PROPANAL, 2-METHYL-2-(METHYLTHIO)-, O-[(METHYLAMINO)CARBONYL]OXIME
P071	METHYL PARATHION; Also known as PHOSPHOROTHIOIC ACID, O, O, O,-DIMETHYL O-(4-NITROPHENYL)ESTER
P072	ALPHA-NAPHTHYLTHIOUREA; Also known as THIOUREA, 1-NAPHTHALENYL-
P073	NICKEL CARBONYL; Also known as NICKEL CARBONYL NI(CO) ₄ , (T-4)-
P074	NICKEL CYANIDE; Also known as NICKEL CYNAIDE NI(CN) ₂
P075	NICOTINE, & SALTS; Also known as PYRIDINE, 3-(1-METHYL-2-PYRROLIDINYL)-, (S)-, & SALTS
P077	BENZENAMINE, 4-NITRO-; Also known as P-NITROANILINE
P078	NITROGEN DIOXIDE; Also known as NITROGEN OXIDE NO ₂
P082	METHANAMINE, N-METHYL-N-NITROSO-; Also known as N-NITROSODIMETHYLAMINE
P084	N-NITROSOMETHYLVINYLAMINE; Also known as VINYLAMINE, N-METHYL-N-NITROSO-
P085	DIPHOSPHORAMIDE, OCTAMETHYL-; Also known as OCTAMETHYLPYROPHOSPHORAMIDE
P087	OSMIUM OXIDE OSO ₄ , (T-4)-; Also known as OSMIUM TETROXIDE

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
P088	ENDOTHALL; Also known as 7-OXABICYCLO[2.2.1]HEPTANE-2,3-DICARBOXYLIC ACID
P089	PARATHION; Also known as PHOSPHORIC ACID, O,O-DIETHYL O-(4-NITROPHENYL)ESTER
P092	MERCURY, (ACETATO-O)PHENYL-; Also known as PHENYLMERCURY ACETATE
P093	PHENYLTHIOUREA; Also known as THIOUREA, PHENYL-
P094	PHORATE; Also known as PHOSPHORODITHIOIC ACID, O,O-DIETHYL; Also known as S-[ETHYLTHIO)METHYL] ESTER
P095	CARBONIC DICHLORIDE; Also known as PHOSGENE
P096	HYDROGEN PHOSPHIDE; Also known as PHOSPHINE
P097	FAMPHUR; Also known as PHOSPHOTHIOIC ACID, O-[4-[(DIMETHYLAMINO)SULFONYL]PHENYL] O,O-DIMETHYL ESTER
P098	POTASSIUM CYANIDE
P099	ARGENTATE(1-), BIS(CYANO-C)-, POTASSIUM; Also known as POTASSIUM SILVER CYANIDE
P101	ETHYL CYANIDE; Also known as PROPANENITRILE
P102	PROPARGYL ALCOHOL; Also known as 1-PROPYN-1-OL
P103	SELENOUREA
P104	SILVER CYANIDE
P105	SODIUM AZIDE
P108	STRYCHNIDIN-10-ONE, & SALTS; Also known as STRYCHNINE, & SALTS
P109	TETRAETHYLDITHIOPYROPHOSPHATE; Also known as THIODIPHOSPHIRIC ACID, TETRAETHYL ESTER
P110	TETRAETHYL LEAD
P113	THALLIUM OXIDE TL_2O_3
P114	THALLIUM(L) SELENITE
P115	THALLIUM(L) SULFATE
P116	THIOSEMICARBAZIDE
P118	TRICHLOROMETHANETHIOL
P119	VANADIC ACID, AMMONIUM SALT
P120	VANADIUM PENTOXIDE
P121	ZINC CYANIDE
P123	TOXAPHENE
U001	ACETALDEHYDE (I); Also known as ETHANAL (I)
U002	ACETONE (I); Also known as 2-PROPANONE (I)
U003	ACETONITRILE (I,T)
U004	ACETONITRILE (I,T)

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
U005	2, ACETYLAMINOFLUORENE; Also known as ACETAMIDE, N-9H-FLUOREN-2-YL-
U007	ACRYLAMIDE; Also known as 2-PROPENAMIDE
U008	ACRYLIC ACID (I); Also known as 2-PROPENOIC ACID (I)
U009	ACRYLONITRILE; Also known as 2-PROPENENITRILE
U010	AZIRINO[2',3':3,4]PYRROLO[1,2-a]INDOLE-4,7-DIONE,6-AMINO-8- [[AMINOCARBONYLOXY]METHYL]-1,1a,2,8,8a,8b-HEXAHYDRO-8a-METHOXY-5-METHYL-, [1aS-(1AALPHA, 8BETA, 8AALPHA, 8BALPHA)]-; Also known as MITOMYCIN C
U011	AMITROLE; Also known as 1H-1,2,-TRIAZOL-3-AMINE
U012	ANILINE (I,T); Also known as BENZENAMINE (I,T)
U014	AURAMINE; Also known as BENZENAMINE, 4,4'-CARBONIMIDOYLBIS[N,N-DIMETHYL-
U015	AZASERINE; Also known as L-SERINE, DIAZOACETATE (ESTER)
U016	BENZ[C]ACRIDINE
U017	BENZAL CHLORIDE; Also known as BENZENE,(DICHLOROMETHYL)-
U018	BENZ[A]ANTHRACENE
U019	BENZENE (I,T)
U022	BENZO[A]PYRENE
U024	DICHLOROMETHOXY ETHANE; Also known as ETHANE, 1,1'-[METHYLENEBIS(OXY)]BIS[2-CHLORO-
U025	DICHLOROETHYL ETHER; Also known as ETHANE,1,1'-OXYBIS[2-CHLORO-
U026	CHLORNAPHAZIN; Also known as NAPHTHALENAMINE, N,N'-BIS(2-CHLOROETHYL)-
U027	DICHLOROISOPROPYL ETHER; Also known as PROPANE, 2,2'-OXYBIS[2-CHLORO-
U028	1,2-BENZENEDICARBOXYLIC ACID, BIS(2-ETHYLHEXYL) ESTER; Also known as DIETHYLHEXYL PHTHALATE
U029	METHANE, BROMO-; Also known as METHYL BROMIDE
U030	BENZENE, 1-BROMO-4-PHENOXY-; Also known as 4-BROMOPHENYL PHENYL ETHER
U031	1-BUTANOL (I); Also known as N-BUTYL ALCOHOL (I)
U032	CHROMIC ACID H ₂ CRO ₄ , CALCIUM SALT; Also known as CALCIUM CHROMATE
U034	CHLORAL; Also known as ACETALDEHYDE, TRICHLORO-
U035	CHLORAMBUCIL; Also known as BENZENE BUTANOIC ACID, 4-[BIS(2-CHLOROETHYL)AMINO]-
U036	CHLORDANE, ALPHA & GAMMA ISOMERS; Also known as 4,7-METHANO-1H-INDENE, 1,2,4,5,6,7,8,8-OCTACHLORO-2,3,3A,4,7,7A-HEXAHYDRO-
U037	CHLOROBENZENE; Also known as BENZENE, CHLORO-
U038	CHLOROBENZILATE; Also known as BENZENEACETIC ACID, 4-CHLORO-ALPHA-(4-CHLOROPHENYL)-ALPHA-HYDROXY-, ETHYL ESTER
U039	P-CHLORO-M-CRESOL; Also known as PHENOL, 4-CHLORO-3-METHYL-
U041	EPICHLOROHYDRIN; Also known as OXIRANE, (CHLOROMETHYL)-

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
U042	2-CHLOROETHYL VINYL ETHER; Also known as ETHENE, (2-CHLOROETHOXY)-
U043	VINYL CHLORIDE; Also known as ETHENE, CHLORO-
U044	CHLOROFORM; Also known as METHANE, TRICHLORO-
U045	METHANE, CHLORO- (I,T); Also known as METHYL CHLORIDE (I,T)
U046	CHLOROMETHYL METHYL ETHER; Also known as METHANE, CHLOROMETHOXY-
U047	BETA-CHLORONAPHTHALENE; Also known as NAPHTHALENE, 2-CHLORO-
U048	O-CHLOROPHENOL; Also known as PHENOL, 2-CHLORO-
U049	4-CHLORO-O-TOLUIDINE, HYDROCHLORIDE; Also known as BENZENAMINE, 4-CHLORO-2-METHYL, HYDROCHLORIDE
U050	CHRYSENE
U051	CREOSOTE
U052	CRESOL (CRESYLIC ACID); Also known as PHENOL, METHYL-
U053	CROTONALDEHYDE; Also known as 2-BUTENAL
U055	CUMENE (I); Also known as BENZENE, (1-METHYLETHYL)- (I)
U056	BENZENE, HEXAHYDRO- (I); Also known as CYCLOHEXANE (I)
U057	CYCLOHEXANONE (I)
U058	CYCLOPHOSPHAMIDE; Also known as 2H-1,3,2-OXAZAPHOSPHORIN-2-AMINE, N,N-BIS (2-CHLOROETHYL)TETRAHYDRO-, 2-OXIDE
U059	DAUNOMYCIN; Also known as 5,12-NAPHTHACENEDIONE, 8-ACETYL-10-[(3-AMINO-2,3,6-TRIDEOXY)-ALPHS-L-LYXO- HEXOPYRANOSY)OXY]-7,8,9,10-TETRAHYDRO-6,8,11-TRIHYDROXY-1-METHOXY-, (8S-CIS)-
U060	DDD; Also known as BENZENE, 1,1'-(2,2-DICHLOROETHYLIDENE)BIS[4-CHLORO-
U061	DDT; Also known as BENZENE, 1,1'-(2,2,2-TRICHLOROETHYLIDENT)BIS[4-CHLORO-
U062	DIALATE; Also known as CARBAMOTHIOIC ACID, BIS(1-METHYLETHYL)-, S-(2,3-DICHLORO-2-PROPENYL) ESTER
U063	DIBENZ[A,H]ANTHRACENE
U064	DIBENZO[A,I]PYRENE; Also known as BENZO[RST]PENTAPHENE
U066	1,2-DIBROMO-3-CHLOROPROPANE; Also known as PROPANE, 1,2-DIBROMO-3-CHLORO-
U067	ETHANE, 1,2-DIBROMO-; Also known as ETHYLENE DIBROMIDE
U068	METHANE, DIBROMO-; Also known as METHYLENE BROMIDE
U069	DIBUTYL PHTHALATE; Also known as 1,2-BENZENEDICARBOXYLIC ACID, DIBUTYL ESTER
U070	o-DICHLOROBENZENE; Also known as BENZENE, 1,2-DICHLORO-
U071	m-DICHLOROBENZENE; Also known as BENZENE, 1,3-DICHLORO-
U072	p-DICHLOROBENZENE; Also known as BENZENE, 1,4-DICHLORO-

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
U073	3,3'-DICHLOROBENZIDINE; Also known as [1,1'-BIPHENYL]-4,4'-DIAMINE, 3,3'DICHLORO-
U074	1,4-DICHLORO-2-BUTENE (I,T); Also known as 2-BUTENE, 1,4-DICHLORO- (I,T)
U075	DICHLORODIFLUOROMETHANE; Also known as METHANE, DICHLORODIFLUORO-
U076	ETHANE, 1,1-DICHLORO-; Also known as ETHYLIDENE DICHLORIDE
U077	ETHANE, 1,2-DICHLORO-; Also known as ETHYLENE DIBROMIDE
U078	1,1-DICHLOROETHYLENE; Also known as ETHENE, 1,1-DICHLORO-
U079	1,2-DICHLOROETHYLENE; Also known as ETHENE, 1,2-DICHLORO-, (E)
U080	METHANE, DICHLORO-; Also known as METHYLENE CHLORIDE
U081	2,4-DICHLOROPHENOL; Also known as PHENOL, 2,4-DICHLORO-
U082	2,6-DICHLOROPHENOL; Also known as PHENOL, 2,6-DICHLORO-
U083	PROPANE, 1,2-DICHLORO-; Also known as PROPYLENE DICHLORIDE
U084	1,3-DICHLOROPROPENE; Also known as 1-PROPENE, 1,3-DICHLORO-
U085	1,2:3,4--DIEPOXYBUTANE (I,T); Also known as 2,2'-BIOXIRANE
U086	N,N'-DIETHYLHYDRAZINE; Also known as HYDRAZINE, 1,2,-DIETHYL-
U087	O,O-DIETHYL S-METHYL DITHIOPHOSPHATE; Also known as PHOSPHORODITHIOIC ACID, 0,0-DIETHYL S-METHYL ESTER
U088	DIETHYL PHTHALATE; Also known 1,2-BENZENEDICARBOXYLIC ACID, DIETHYL ESTER
U089	DIETHYLSTILBESTEROL; Also known as PHENOL, 4,4'-(1,2-DIETHYL-1,2-ETHENEDIYL)BIS-, (E)
U090	DIHYDROSAFROLE; Also known as 1,3-BENZODIOXOLE, 5-PROPYL-
U091	3,3'-DIMETHOXYBENZIDINE; Also known as [1,1'-BIPHENYL]-4,4'-DIAMINE, 3,3'DIMETHOXY-
U092	DIMETHYLAMINE (I); Also known as METHANAMINE, N-METHYL- (I)
U093	BENZENAMINE, N,N-DIMETHYL-4-(PHENYLAZO)-; Also known as P-DIMETHYLAMINOAZOBENZENE
U094	BENZ[A]ANTHRACENE, 7,12-DIMETHYL-; Also known as 7,12-DIMETHYLBENZ[A]ANTHRACENE
U095	3,3'-DIMETHYLBENZIDINE; Also known as [1,1'-BIPHENYL]-4,4'-DIAMINE, 3,3'DIMETHYL-
U097	DIMETHYLCARBAMOYL CHLORIDE; Also known as CARBAMIC CHLORIDE, DIMETHYL-
U098	1,1-DIMETHYLHYDRAZINE; Also known as HYDRAZINE, 1,1-DIMETHYL-
U099	1,2-DIMETHYLHYDRAZINE; Also known as HYDRAZINE, 1,2,-DIMETHYL-
U101	2,4-DIMETHYLPHENOL; Also known as PHENOL, 2,4-DIMETHYL-
U102	DIMETHYL PHTHALATE; Also known as 1,2-BENZENEDICARBOXYLIC ACID, DIMETHYL ESTER
U103	DIMETHYL SULFATE; Also known as SULFURIC ACID, DIMETHYL ESTER
U105	2,4-DINITROTOLUENE; Also known as BENZENE, 1-METHYL-2,4-DINITRO-

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
U106	2,6-DINITROTOLUENE; Also known as BENZENE, 2-METHYL-1,3-DINITRO-
U107	DI-N-OCTYL PHTHALATE; Also known as 1,2-BENZENEDICARBOXYLIC ACID, DIOCTYL ESTER
U108	1,4-DIETHYLENEOXIDE; Also known as 1,4-DIOXANE
U109	1,2-DIPHENYLHYDRAZINE; Also known as HYDRAZINE, 1,2-DIPHENYL-
U110	DIPROPYLAMINE (I); Also known as 1-PROPANAMINE, N-PROPYL- (I)
U111	DI-N-PROPYLNITROSAMINE; Also known as 1-PROPANAMINE, N-NITROSO-N-PROPYL-
U112	ACETIC ACID ETHYL ESTER (I); Also known as ETHYL ACETATE (I)
U113	ETHYL ACRYLATE (I); Also known as 2-PROPENOIC ACID, ETHYL ESTER (I)
U114	ETHYLENEBISDITHIOCARBAMIC ACID, SALTS & ESTERS; Also known as CARBAMODITHIOIC ACID, 1,2- ETHANEDIYLBIS-, SALTS & ESTERS
U115	ETHYLENE OXIDE (I,T); Also known as OXIRANE (I,T)
U116	ETHYLENETHIOUREA; Also known as 2-IMIDAZOLIDINETHIONE
U117	ETHANE, 1,1'-OXYBIS-(I); Also known as ETHYL ETHER (I)
U118	ETHYL METHACRYLATE; Also known as 2-PROPENOIC ACID, 2-METHYL-, ETHYL ESTER
U119	ETHYL METHANESULFONATE; Also known as METHANESULFONIC ACID, ETHYL ESTER
U120	FLUORANTHENE
U121	TRICHLOROMONOFUOROMETHANE; Also known as METHANE, TRICHLOROFLUORO-
U122	FORMALDEHYDE
U124	FURAN (I); Also known as FURFURAN (I)
U125	2-FURANCARBOXALDEHYDE (I); Also known as FURFURAL (I)
U126	GLYCIDYLALDEHYDE; Also known as OXIRANECARBOXYALDEHYDE
U127	HEXACHLOROBENZENE; Also known as BENZENE, HEXACHLORO-
U128	HEXACHLOROBUTADIENE; Also known as 1,3-BUTADIENE, 1,1,2,3,4,4-HEXACHLORO-
U129	LINDANE; Also known as CYCLOHEXANE, 1,2,3,4,5,6- HEXACHLORO-, (1ALPHA, 2ALPHA, 3BETA, 4ALPHA, 5ALPHA, 6BETA)-
U130	HEXACHLOROCYCLOPENTADIENE; Also known 1,3-CYCLOPENTADIENE, 1,2,3,4,5,5-HEXACHLORO-
U131	HEXACHLOROETHANE; Also known as ETHANE, HEXACHLORO-
U132	HEXACHLOROPHENE; Also known as PHENOL, 2,2'-METHYLENEBIS[3,4,6-TRICHLORO-
U135	HYDROGEN SULFIDE; Also known HYDROGEN SULFIDE H ₂ S
U136	ARSINIC ACID, DIMETHYL-; Also known as CACODYLIC ACID
U137	INDENO[1,2,3-CD]PYRENE
U138	METHANE, IODO-; Also known as METHYL IODIDE
U140	ISOBUTYL ALCOHOL, (I,T); Also known as 1-PROPANOL, 2-METHYL-, (I,T)

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
U141	ISOSAFROLE; Also known as 1,3-BENZODIOXOLE, 5-(1-PROPENYL)-
U142	KEPONE; Also known as 1,3,4-METHENO-2H-CYCLOBUTA[CD]PENTALEN-2-ONE, 1,1A,3,3A,4,5,5A,5B,6- DECACHLOROOCCTAHYDRO-
U143	LASIOCARPINE; Also known as 2-BUTENOIC ACID, 2-METHYL-, 7-[2,3-DIHYDROXY-2-(1-METHOXYETHYL)-3-METHYL-1- OXOBUTOXY]METHYL]- 2,3,5,6A-TETRAHYDRO-1H-PYRROLIZIN-1-YL ESTER,[1S- 1ALPHA(Z),7(2S*,3R*),7AALPHA]]-
U144	ACETIC ACID, LEAD(2+) SALT; Also known as LEAD ACETATE
U145	LEAD PHOSPHATE; PHOSPHORIC ACID, LEAD(2+) SALT (2:3)
U146	LEAD, BIS(ACETATO-O) TETRAHYDROXYTRI-; Also known as LEAD SUBACETATE
U147	MALEIC ANHYDRIDE; Also known as 2,5-FURANDIONE
U148	MALEIC HYDRAZIDE; Also known as 3,6-PYRIDAZINEDIONE, 1,2-DIHYDRO-
U149	MALONONITRILE; Also known as PROPANEDINITRILE
U150	MELPHALAN; Also known as L-PHENYLALANINE, 4-[BIS(2-CHLOROETHYL)AMINO]-
U151	MERCYR
U152	METHACRYLONITRILE (I,T); Also known as 2-PROPENENITRILW, 2-METHYL- (I,T)
U153	METHANETHIOL (I,T); Also known as THIOMETHANOL (I,T)
U154	METHANOL (I); Also known as METHYL ALCOHOL (I)
U155	METHAPYRILENE; Also known 1,2-ETHANEDIAMINE, N,N- DIMETHYL-N'-W-PYRIDINYL-N'-(2- THIENYLMETHYL)-
U156	METHYL CHLOROCARBONATE (I,T); Also known CARBONOCHLORIDIC ACID, METHYL ESTER (I,T)
U157	BENZ[I]ACEANTHRYLENE, 1,2-DIHYDRO-3-METHYL-; Also known as 3-METHYLCHOLANTHRENE
U158	BENZENAMINE, 4,4'METHYLENEBIS[2-CHLORO-; Also known as 4,4'-METHYLENEBIS(2-CHLOROANILINE)
U159	METHYL ETHYL KETONE (MEK) (I,T); Also known as 2-BUTANONE (I,T)
U161	METHYL ISOBUTYL KETONE (I); Also known as 4-METHYL-2-PENTANONE (I) and PENTANOL, 4-METHYL-
U162	METHYL METHACRYLATE (I,T); Also known as 2-PROPENOIC ACID, 2-METHYL-, METHYL ESTER (I,T)
U163	MNNG; Also known as GUANIDINE, N-METHYL-N'-NITRO-N- NITROSO-
U164	METHYLTHIOURACIL; Also known as 4(1H)-PYRIMIDINONE, 2,3-DIHYDRO-6-METHYL-2-THIOXO-
U165	NAPHTHALENE
U166	1,4-NAPHTHALENEDIONE; Also known as 1,4-NAPHTHOQUINONE
U167	1-NAPHTHALENAMINE; Also known as ALPHA-NAPHTHYLAMINE
U168	2-NAPHTHALENAMINE; Also known as BETA-NAPHTHYLAMINE

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
U169	NITROBENZENE (I,T); Also known as BENZENE, NITRO-
U170	P-NITROPHENOL; Also known as PHENOL, 4-NITRO
U171	2-NITROPROPANE (I,T); Also known as PROPANE, 2-NITRO (I,T)
U172	N-NITROSODI-N-BUTYLAMINE; Also known as 1-BUTANAMINE, N-BUTYL-N-NITROSO-
U173	N-NITROSODIETHANOLAMINE; Also known as ETHANOL, 2,2'-(NITROSOIMINO)BIS-
U174	N-NITROSODIETHYLAMINE; Also known as ETHANAMINE, N-ETHYL-N-NITROSO-
U176	N-NITROSO-N-ETHYLUREA; Also known as UREA, N-ETHYL-N-NITROSO-
U177	N-NITROSO-N-METHYLUREA; Also known as UREA, N-METHYL-N-NITROSO-
U178	N-NITROSO-N-METHYLURETHANE; Also known as CARBAMIC ACID, METHYLNITROSO-,ETHYL ESTER
U179	N-NITROSOPIPERIDINE; Also known as PIPERIDINE, 1-NITROSO-
U180	N-NITROSOPYRROLIDINE; Also known as PYRROLIDINE, 1-NITROSO-
U181	BENZENAMINE, 2-METHYL-5-NITRO-; Also known as 5-NITRO-O-TOLUIDINE
U182	PARALDEHYDE; Also known as 1,3,5-TRIOXANE, 2,4,6- TRIMETHYL-
U183	PENTACHLOROBENZENE; Also known as BENZENE, PENTACHLORO-
U184	PENTACHLOROETHANE; Also known as ETHANE, PENTACHLORO-
U185	PENTACHLORONITROBENZENE (PCNB); Also known as BENZENE, PENTACHLORONITRO-
U186	1,3-PENTADIENE (I); Also known as 1-METHYLBUTADIENE (I)
U187	ACETAMIDE, N-(4-ETHOXYPHENYL)-; Also known as PHENACETIN
U188	PHENOL
U190	PHTHALIC ANHYDRIDE; Also known as 1,3-ISOBENZOFURANDIONE
U191	2-PICOLINE; Also known as PYRIDINE, 2-METHYL-
U192	BENZAMIDE,3,5-DICHLORO-N-(1,1-DIMETHYL-2-PROPYNYL)-; Also known as PRONAMIDE
U193	1,3-PROPANE SULTONE; Also known as 1,2-OXATHIOLANE, 2,2-DIOXIDE
U194	1-PROPANAMINE (I,T); Also known as N-PROPYLAMINE (I,T)
U196	PYRIDINE
U197	P-BENZOQUINONE; Also known as 2,5-CYCLOHEXADIENE-1,4-DIONE
U200	RESERPINE; Also known as YOHIMBAN-16-CARBOXYLIC ACID, 11,17-DIMETHOXY-18- [(3,4,5-TRIMETHOXYBENZOYL)OXY]-, METHYL ESTER, (3BETA, 16BETA, 17ALPHA, 18BETA, 20ALPHA)-
U201	RESORCINOL; Also known as 1,3-BENZENEDIOL
U202	SACCHARIN, & SALTS; Also known as 1,2-BENZISOTHIAZOL-3(2H)-ONE, 1,1-DIOXIDE, & SALTS
U203	SAFROLE; Also known as 1,3-BENZODIOXOLE, 5-(2- PROPENYL)-
U204	SELENIOUS ACID; Also known as SELENIUM DIOXIDE

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
U206	STREPTOZOTOCIN; Also known as GLUCOPYRANOSE, 2-DEOXY-2-(3-METHYL-3-NITROSOUREIDO)-, D-D-GLUCOSE, 2-DEOXY-2-[[[(METHYLNITROSOAMINO)-CARBONYL]AMINO]-
U207	1,2,4,5-TETRACHLOROBENZENE; Also known as BENZENE, 1,2,4,5-TETRACHLORO-
U208	1,1,1,2-TETRACHLOROETHANE; Also known as ETHANE, 1,1,1,2-TETRACHLORO-
U209	1,1,2,2-TETRACHLOROETHANE; Also known as ETHANE, 1,1,2,2-TETRACHLORO-
U210	TETRACHLOROETHYLENE; Also known as ETHENE, TETRACHLORO-
U211	CARBON TETRACHLORIDE; Also known as METHANE, TETRACHLORO-
U213	TETRAHYDROFURAN (I); Also known as FURAN, TETRAHYDRO-(I)
U214	ACETIC ACID, THALLIUM(1+) SALT; Also known as THALLIUM(I) ACETATE
U215	THALLIUM(I) CARBONATE; Also known as CARBONIC ACID, DITHALLIUM(1+) SALT
U216	THALLIUM(I) CHLORIDE; Also known as THALLIUM CHLORIDE TLCL
U217	THALLIUM(I) NITRATE; Also known as NITRIC ACID, THALLIUM(1+) SALT
U218	THIOACETAMIDE; Also known as ETHANETHIOAMIDE
U219	THIOUREA
U220	TOLUENE; Also known as BENZENE, METHYL-
U221	TOLUENEDIAMINE; Also known as BENZENEDIAMINE, AR-METHYL-
U222	BENZENAMINE, 2-METHYL-, Also known as HYDROCHLORIDE O-TOLUIDINE HYDROCHLORIDE
U225	BROMOFORM; Also known as METHANE, TRIBROMO-
U226	ETHANE, 1,1,1-TRICHLORO-; Also known as METHYL CHLOROFORM
U227	1,1,2-TRICHLOROETHANE; Also known as ETHANE, 1,1,2-TRICHLORO-
U228	TRICHLOROETHYLENE; Also known as ETHENE, TRICHLORO-
U235	TRIS(2,3-DIBROMOPROPYL) PHOSPHATE; Also known as 1-PROPANOL, 2,3-DIBROMO-, PHOSPHATE (3:1)
U236	TRYPAN BLUE; Also known as 2,7-NAPHTHALENEDISULFONIC ACID, 3,3'-[(3,3'-DIMETHYL[1,1'-BIPHENYL]-4,4'-DIYL)BIS(AZO)BIS[5-AMINO-4-HYDROXY]-, TETRASODIUM SALT
U237	URACIL MUSTARD; Also known as 2,4-(1H,3H)-PYRIMIDINEDIONE, 5-[BIS(2-CHLOROETHYL)AMINO]-
U238	CARBAMIC ACID, ETHYL ESTER; Also known as ETHYL CARBAMATE (URETHANE)
U239	XYLENE (I); Also known as BENZENE, DIMETHYL- (I,T)
U240	ACETIC ACID, 92,4-DICHLOROPHENOXY)-, SALTS & ESTERS; Also known as 2,4-D, SALTS & ESTERS
U243	HEXACHLOROPROPENE; Also known as 1-PROPENE, 1,1,2,3,3,3- HEXACHLORO-
U244	THIOPEROXYDICARBONIC DIAMIDE [(H ₂ N)C(S)] ₂ S ₂ , TETRAMETHYL-; Also known as THIRAM
U246	CYANOGEN BROMIDE (CN)Br

TABLE C-1 -- HAZARDOUS WASTES RECEIVED AT THE PARKER FACILITY

EPA WASTE CODE	WASTE DESCRIPTION
U247	BENZENE, 1,1'(2,2,2-TRICHLOROETHYLIDENE)BIS[4-METHOXY-; Also known as METHOXYCHLOR
U248	WARFARIN, & SALTS, WHEN PRESENT AT CONCENTRATIONS OF 0.3% OR LESS; Also known as 2H-1-BENZOPYRAN-2-ONE, 4- HYDROXY-3-(3-OXO-1-PHENYL-BUTYL)-, & SALTS, WHEN PRESENT AT CONCENTRATIONS OF 0.3% OR LESS
U249	ZINC PHOSPHIDE Zn_3P_2 WHEN PRESENT AT CONCENTRATIONS OF 10% OR LESS
U328	BENZENAMINE, 2-METHYL-; Also known as o-TOLUIDINE
U353	BENZENAMINE, 4-METHYL-; Also known as p-TOLUIDINE
U359	ETHANOL, 2-ETHOXY-; Also known as ETHYLENE GLYCOL MONOETHYL ETHER

Table C-2

Spent Activated Carbon Organic Constituent Data Summary				
Constituent	CAS NO.	Organics (lb constituent per lb spent activated carbon)		
		Minimum	Maximum	Average
1-Butanol	71-36-3	8.67E-04	8.67E-04	8.67E-04
1-Hexane	110-54-3	3.86E-04	8.45E-02	4.24E-02
1,1 Dichloroethane	75-34-3	9.00E-09	3.20E-02	9.71E-04
1,1 Dichloroethene	75-35-4	2.50E-10	2.94E-01	2.51E-03
1,1,1 Trichloroethane	71-55-6	2.50E-09	3.43E-01	1.31E-02
1,1,2 Trichloroethane	79-00-5	5.00E-07	1.41E-02	3.28E-03
1,1,2,2 Tetrachloroethane	79-34-5	1.45E-05	3.31E-04	2.29E-04
1,2 Dibromoethane	106-93-4	2.50E-08	1.98E-02	4.57E-03
1,2 Dichlorobenzene	95-50-1	2.05E-05	4.60E-03	9.99E-04
1,2 Dichloroethane	107-06-2	0.00E+00	1.39E-01	7.18E-03
1,2 Dichloroethene	540-59-0	2.50E-08	7.32E-03	2.13E-03
1,2 Dichloropropane	78-87-5	3.00E-09	5.30E-02	6.06E-03
1,2,3 Trichloropropane	96-18-4	3.72E-06	3.72E-06	3.72E-06
1,2,4 Trimethylbenzene	95-63-6	1.10E-07	4.80E-04	3.84E-04
1,2-Dichloroethene (cis)	156-59-2	1.00E-09	2.63E-03	1.39E-03
1,2-Dichloroethene (trans)	156-60-5	7.32E-05	5.44E-04	3.65E-04
1,3 Dichlorobenzene	541-73-1	7.40E-05	5.48E-04	1.70E-04
1,4 Dichlorobenzene	106-46-7	2.50E-08	3.44E-03	5.20E-04
2,3,4,6 Tetrachlorophenol	58-90-2	1.82E-05	1.82E-05	1.82E-05
2-Butanol	78-92-2	5.90E-04	5.90E-04	5.90E-04
2-Butoxyethanol	111-76-2	2.73E-03	2.73E-03	2.73E-03
2-ethyl-1-Methylbenzene	611-14-3	9.40E-05	9.40E-05	9.40E-05
2-methoxy-1-Propanol		6.24E-03	6.24E-03	6.24E-03
2-Methylnaphthalene	91-57-6	1.63E-05	1.34E-03	4.61E-04
2-Methylphenol (o-Cresol)	95-48-7	2.14E-05	2.14E-05	2.14E-05
3-/4-Methylphenol (m&p Cresol)	108-39-4 & 106-44-5	3.40E-05	3.40E-05	3.40E-05
4-ethyl-1-Methylbenzene		8.10E-05	8.10E-05	8.10E-05
Acenaphthalene	208-96-8	3.36E-05	6.26E-04	3.30E-04
Acenaphthene	83-32-9	2.81E-06	2.41E-05	1.09E-05
Acenaphthylene		1.18E-06	2.66E-06	1.92E-06
Acetone	67-64-1	4.51E-03	8.49E-03	6.50E-03
Acrylic Acid	79-10-7	2.50E-05	2.50E-05	2.50E-05
Acrylonitrile	107-13-1	9.30E-06	9.30E-06	9.30E-06
Aldrin	309-00-2	6.60E-07	6.60E-07	6.60E-07
Aniline	62-53-3	2.51E-05	4.26E-04	1.47E-04
Benzene	71-43-2	2.50E-10	9.25E-02	1.44E-03
Benzo(a)Anthracene	56-55-3	5.60E-07	2.10E-06	1.33E-06
Benzo(b)Fluoranthene	205-99-2	2.30E-07	4.00E-07	3.20E-07
Bromodichloromethane	75-27-46	3.00E-05	6.18E-04	4.06E-04
Butane	106-97-8	9.69E-06	9.69E-06	9.69E-06
Butyl Acetate	123-86-4	1.36E-02	1.36E-02	1.36E-02
Carbon Tetrachloride	56-23-5	3.00E-08	1.36E-02	5.39E-04
Chlorobenzene	108-90-7	2.50E-08	2.75E-03	4.76E-04
Chloroethane	75-00-3	3.89E-03	3.89E-03	3.89E-03

Table C-2

Spent Activated Carbon Organic Constituent Data Summary				
Constituent	CAS NO.	Organics (lb constituent per lb spent activated carbon)		
		Minimum	Maximum	Average
Chloroform	67-66-3	1.40E-08	2.08E-02	1.05E-02
Chloromethane	74-87-3	2.06E-04	2.06E-04	2.06E-04
Chrysene	218-01-9	6.40E-07	6.40E-07	6.40E-07
Cresol	1319-77-3	5.10E-05	1.74E-04	1.13E-04
Cumene	98-82-8	5.78E-06	1.65E-03	4.37E-04
Dibenzofuran	132-64-9	7.66E-06	2.61E-05	1.69E-05
Dicyclopentadiene	77-73-6	6.06E-04	6.49E-02	1.68E-02
Dioxane	123-91-1	1.16E-04	9.20E-04	5.18E-04
Ethanol	64-17-5	3.56E-04	3.56E-04	3.56E-04
Ethyl Acetate	141-78-6	5.87E-03	5.87E-03	5.87E-03
Ethylbenzene	100-41-4	5.00E-10	2.30E-02	1.14E-03
Ethylene Glycol	107-21-1	2.94E-01	2.94E-01	2.94E-01
Fluoranthene	206-44-0	3.11E-06	2.90E-05	1.61E-05
Freon 113	76-13-1	1.10E-09	1.10E-09	1.10E-09
Isobutane	75-28-5	1.42E-02	1.42E-02	1.42E-02
Isopar C		1.27E-03	5.48E-02	2.80E-02
Isopropyl Alcohol	67-63-0	7.00E-03	7.00E-03	7.00E-03
Lindane	58-89-9	1.54E-09	6.70E-06	1.28E-06
m&p-Xylenes	108-38-3 &106-42-3	7.20E-08	2.89E-03	5.90E-04
Methanol	67-56-1	1.36E-01	1.36E-01	1.36E-01
Methoxychlor	72-43-5	2.80E-06	2.80E-06	2.80E-06
Methyl ethyl ketone	78-93-3	1.20E-08	4.10E-03	1.40E-03
Methyl Isobutyl ketone	108-10-1	5.00E-06	4.24E-02	2.94E-03
Methyl methacrylate	80-62-6	2.50E-08	2.50E-08	2.50E-08
methyl tert-butyl ether	1634-04-4	1.22E-07	4.66E-02	5.86E-03
Methylene chloride	75-09-2	1.90E-08	1.30E-01	1.63E-03
Methylnaphthalene	28804-88-8	3.54E-06	5.03E-06	4.29E-06
Naphthalene	91-20-3	6.00E-09	4.93E-03	4.31E-04
n-Hexane	110-54-3	5.51E-04	8.25E-03	4.40E-03
Nitrobenzene	98-95-3	6.99E-06	3.14E-02	4.50E-03
o-Xylene	95-47-6	2.50E-09	9.00E-05	1.22E-05
Pentachlorophenol	87-86-5	1.00E-06	3.97E-03	7.36E-04
Phenanthrene	85-01-8	3.20E-07	2.95E-05	1.08E-05
Phenol	108-95-2	2.00E-07	4.03E-03	1.27E-03
Polychlorinated Biphenyls	1336-36-3	8.00E-07	3.50E-06	2.15E-06
Propylbenzene	103-65-1	9.00E-05	9.00E-05	9.00E-05
Propylene glycol monomethyl ether acetate	107-98-2	1.45E-02	1.45E-02	1.45E-02
Propylene oxide	75-56-9	4.30E-09	4.00E-03	1.00E-03
Styrene	100-42-5	2.50E-08	3.97E-02	3.57E-03
Tetrachloroethane	630-20-6 & 79-34-5	2.96E-03	2.96E-03	2.96E-03
Tetrachloroethylene	127-18-4	0.00E+00	1.59E-01	1.84E-02
Tetrahydrofuran	109-99-9	4.16E-04	4.16E-04	4.16E-04

Table C-2

Spent Activated Carbon Organic Constituent Data Summary				
Constituent	CAS NO.	Organics (lb constituent per lb spent activated carbon)		
		Minimum	Maximum	Average
Toluene	108-88-3	1.60E-09	1.30E-01	8.68E-03
Trichloroethylene	79-01-6	2.50E-09	2.17E-01	2.24E-03
Trichlorofluoromethane	75-69-4	1.00E-07	4.00E-02	1.42E-03
Triethylamine	121-44-8	9.54E-03	9.54E-03	9.54E-03
Tris(hydroxymethyl) Aminomethane		1.77E-02	1.77E-02	1.77E-02
Vinyl Chloride	75-01-4	2.30E-08	2.40E-05	2.58E-06
Xylene	1330-20-7	8.00E-10	1.59E-01	3.41E-03

All data reported on a dry carbon basis.

Note: The information presented in this table is considered typical but should not be considered limiting.

Table C-3
Spent Activated Carbon Characterization Summary

Stream Type: Solid

Stream Name: Spent Activated Carbon

Feed Method: Dewatering screw, conveyor belt and rotary airlock

Constituent/Property	Units	Value	
		Typical	Range
Organic Constituents (a)			
Total organics	wt%	3.1	2 - 4
Inorganic Constituents			
Water	wt%	43.5	30 - 50
RCRA Metals (a)			
Antimony	mg/kg	<10	<10
Arsenic	mg/kg	2.8	1.2 - 19
Barium	mg/kg	38.3	1 - 110
Beryllium	mg/kg	0.5	<0.1 - 0.7
Cadmium	mg/kg	0.7	<0.5 - 6.9
Chromium	mg/kg	11	3.1 - 240
Chromium (VI)	mg/kg	<0.9	<1
Lead	mg/kg	2.7	<2 - 25
Mercury	mg/kg	0.1	0 - 0.5
Nickel	mg/kg	21.3	7.5 - 140
Selenium	mg/kg	<2	<1 - 3.9
Silver	mg/kg	1	<0.5 - 1.6
Thallium	mg/kg	10.7	<5 - 29
Other Metals (a)			
Cobalt	mg/kg	4.8	2.1 - 19
Copper	mg/kg	31.4	12 - 60
Manganese	mg/kg	223	54 - 590
Vanadium	mg/kg	6.2	3.7 - 7.9
Zinc	mg/kg	35.4	22 - 44
Elemental Composition (b)			
Carbon (from spent carbon)	wt%	94.5	70 - 99
Carbon (from organic adsorbed on carbon)	wt%	2.9	1.6 - 25
Hydrogen	wt%	0.4	0.2 - 8
Oxygen	wt%	0.5	0.3 - 5
Nitrogen	wt%	0.1	0.06 - 0.5
Sulfur	wt%	0	<0.1
Phosphorous	wt%	0	<0.1
Chlorine/chloride	wt%	1.5	0 - 5
Bromine/bromide	wt%	0	<0.1
Fluorine/fluoride	wt%	0	<0.1
Iodine/iodide	wt%	0	<0.1

(a) - As fed basis (wet)

(b) - Dry basis (as received)

Note: The information presented in this table is considered typical but should not be considered limiting.

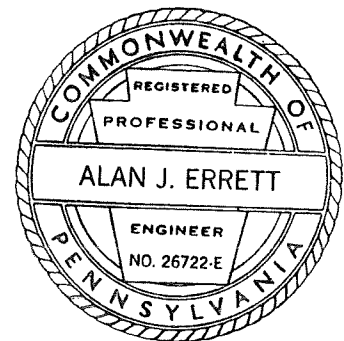
APPENDIX C

STRUCTURAL CALCULATIONS FOR TANKS T-1, T-2, T-5 AND T-6

ANALYSIS OF ACTIVATED
CARBON / WATER SLURRY
STORAGE TANKS (T1, T2, T5, T6) AT
SIEMENS WATER TREATMENT CORP.
IN PARKER, ARIZONA

Prepared For:

Chavond-Barry Engineering Corp.
400 County Route 518
P.O. Box 205
Blawenburg, NJ 08504



Design Engineering Analysis Corporation
335 Morganza Road
Canonsburg, PA 15317
Phone: (724) 743-3322
Fax: (724) 743-0934

Prepared By


Alan J. Errett

December 2011

DESIGN ENGINEERING ANALYSIS CORPORATION



REPORT NO. DEAC-TR-1473	REV. NO.	PROJECT NO. CBE-11-001	PAGE ii
----------------------------	----------	---------------------------	------------

TABLE OF CONTENTS

	<u>Page</u>
1.0 SUMMARY	1
2.0 DESCRIPTION OF TANK DESIGN AND MEASURED THICKNESSES	3
3.0 FINITE ELEMENT MODEL, METHODS AND ASSUMPTIONS	5
4.0 FEA RESULTS AND EVALUATION PER AWWA D100-05	11
5.0 ASME SECTION VIII, DIV. 1 CODE CALCS	26
6.0 REFERENCES	27
APPENDIX A - Wind and Seismic Loads per IBC 2012	28
APPENDIX B - PV Elite Report for ASME Code Calcs	32
APPENDIX C - E-mails from Chavond-Barry	61

DESIGN ENGINEERING ANALYSIS CORPORATION



REPORT NO. DEAC-TR-1473	REV. NO.	PROJECT NO. CBE-11-001	PAGE 1
----------------------------	----------	---------------------------	-----------

1.0 SUMMARY

At the Siemens facility in Parker, Arizona, four identical storage tanks, designated as T1, T2, T5, and T6, are used for storage of an activated carbon/water slurry. The 300 series stainless steel tanks were manufactured in 1956 and have been in service at the facility since August of 1992. The slurry, with a specific gravity of 1.5, is stored at atmospheric pressure and 150°F max.

Recent thickness measurements indicate that there has been some relatively minor thinning of the tanks (primarily in the bottom cone) since the previous analysis was performed in 1994. This report describes the analysis of the tanks based on the current measured minimum thicknesses, using wind and seismic loadings based on the latest edition of the International Building Code (Reference 1).

Current measured thickness data for the analysis were provided by Chavond-Barry Engineering Corp. The analysis is based on the minimum thickness of each of the major components (top head, cylindrical shell, bottom cone) for any of the four tanks. A description of the tank design and thickness data is provided in Section 2.

Since a design code has not been specified for the storage tanks, the analysis is based on a combination of several codes. The wind and seismic loads are calculated based on the 2012 Edition of IBC (Reference 1). These calculations are included in Appendix A. A finite element analysis is performed for the wind/weight/hydrostatic pressure load combination and for the seismic/weight/hydrostatic pressure load combination. The finite element stress results are compared to allowable stresses from AWWA D100-05 (Reference 2). The FEA model and methods are described in Section 3.0 and the results are presented and compared to AWWA D100-05 allowables in Section 4.0. It is shown that the calculated stresses meet the AWWA D100-005 allowable stresses.

In addition to the FEA/AWWA evaluation, a second analysis is performed based on the ASME Boiler

DESIGN ENGINEERING ANALYSIS CORPORATION



REPORT NO. DEAC-TR-1473	REV. NO.	PROJECT NO. CBE-11-001	PAGE 2
----------------------------	----------	---------------------------	-----------

and Pressure Vessel Code, Section VIII, Division 1 (Reference 3). This analysis is performed using the PV Elite pressure vessel design software (Reference 4), and is described in Section 5. The scope of the ASME Code is limited to vessels with a design pressure of at least 15 psig. The Section VIII, Div. 1 analysis is conservatively based on an internal pressure of 15 psig plus the hydrostatic pressure of the fill-level slurry with 1.5 specific gravity. It is shown that the basic Code limits are satisfied.

Both of the approaches outlined above demonstrate that, with the latest IBC wind/seismic loads and the minimum thickness data provided, the tanks are acceptable for atmospheric storage of the 1.5 SG slurry. The seismic load for the operating case (slurry to fill line) is more critical than the wind loading, but the seismic stresses in the tank are very low compared to the stresses due to weight/hydrostatic pressure. The critical component is the conical bottom, where the hydrostatic pressure loading produces local compressive stresses at the cone/cylinder intersection which are approximately 85% of the allowable local buckling stress from AWWA D100-05.

REPORT NO. DEAC-TR-1473	REV. NO.	PROJECT NO. CBE-11-001	PAGE 3
----------------------------	----------	---------------------------	-----------

2.0 DESCRIPTION OF TANK DESIGN AND MEASURED THICKNESSES

The basic design features and current thickness data for the analysis of the tanks were proved to Design Engineering Analysis Corporation by Chavond-Barry Engineering in several e-mails. These e-mails are included in Appendix C. Figure 2-1 shows the tank design and thickness data provided.

As shown on Figure 2-1, the tanks have a 10' inside diameter and are approximately 25-1/2' in overall height. The tanks consist of a 16' cylindrical section with an umbrella roof and an 8' bottom cone. The tanks are supported by a 3' high skirt at the cylinder cone intersection. Minimum thicknesses for the major components are:

Cylinder: $t_{\min} = 0.176''$

Roof: $t_{\min} = 0.183''$

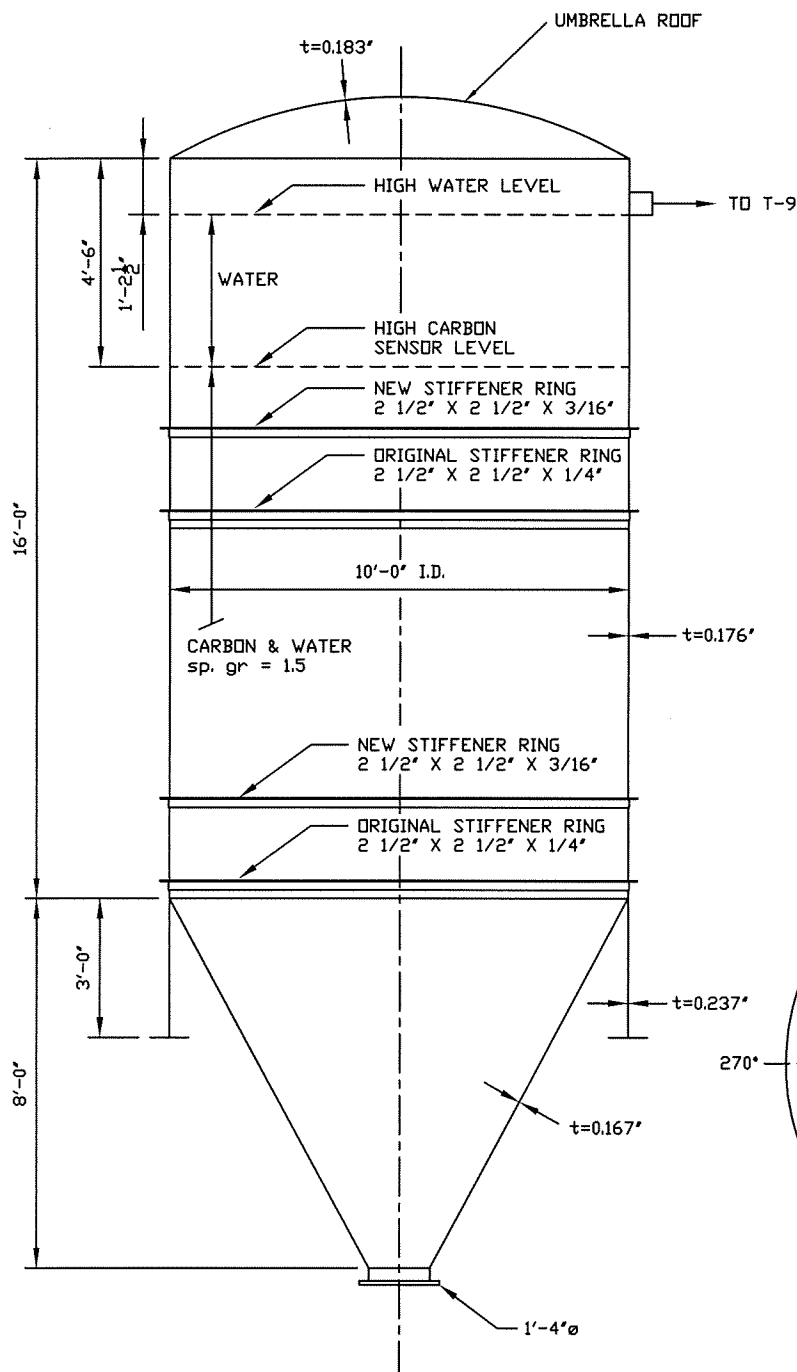
Cone: $t_{\min} = 0.167''$

Skirt: $t_{\min} = 0.237''$

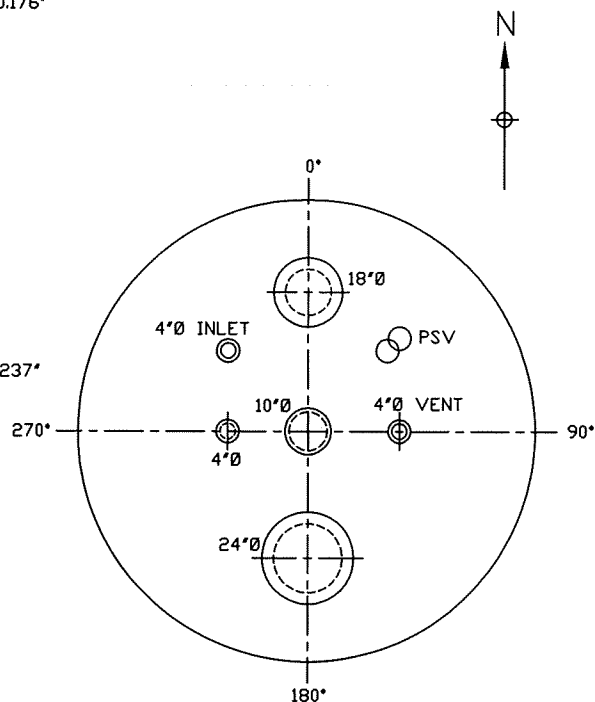
There are two original stiffening rings and two added stiffening rings on the cylinder. Due to the corroded condition of the right angle bend, the original 2-1/2" x 2-1/2" x 1/4" carbon steel angle stiffeners are assumed to be reduced to 2" x 1/4" bars. The new carbon steel stiffeners are 2-1/2" x 2-1/2" x 3/16" angles.

The finite element model described in the following section is based on the dimensions and thickness data shown on Figure 2-1. Figure 2-1 also shows the carbon/water levels and specific gravity of the stored slurry. The analysis is conservatively based on a max slurry level 14.5" below the top of the cylinder. The water only portion of the contents is conservatively assumed to be slurry with the 1.5 specific gravity.

TANK MINIMUM THICKNESS DATA



TYPICAL SHELL ELEVATION
GEOMETRY & MINIMUM THICKNESS DATA
SHOWN FOR TANKS
T-1, T-2, T-5, AND T-6



TYPICAL ROOF VIEW
(TANK T-1 SHOWN)
REFER TO EACH TANK DRAWING
FOR DETAILS AND ORIENTATION

TANK GEOMETRY AND MINIMUM THICKNESS DATA T TANKS T-1, T-2, T-5, AND T-6				NO	DWN	CK'D	APP	REVISIONS	DATE
DRAWN				CBE				CHAVOND-BARRY ENGINEERING CORP.	
DATE				NJ Certificate of Authorization Number: 24GA27984700				400 Route 518 • P.O. Box 205 • Blawenburgh, New Jersey 08504	
CHECKED				SIEMENS WATER TECHNOLOGIES CORP.				2523 MUTAHAR STREET	
APPROVED				PARKER, ARIZONA 85344					
JBE	10/24/11	KEM	10/24/11						
SCALE									
1/4"=1'-0"									
DWG. NO.									
1541-SK-11005									
REV.									
0									

Figure 2-1

REPORT NO. DEAC-TR-1473	REV. NO.	PROJECT NO. CBE-11-001	PAGE 5
----------------------------	----------	---------------------------	-----------

3.0 FINITE ELEMENT MODEL, METHODS AND ASSUMPTIONS

The tank design described in Section 2.0 is analyzed using a detailed finite element model. The modeling and analysis are performed using the ANSYS finite element program (Reference 5). All components, including the cylinder, umbrella roof, bottom cone, support skirt, and stiffening rings are modeled using ANSYS SHELL63 elements. Thickness input for the various components is per the minimum measured thickness data provided by Chavond-Barry Engineering and shown on Figure 2-1.

The ANSYS finite element model is shown on Figures 3-1 through 3-5. The colors shown on these figures represent the various real constants (thickness input). The specified thickness corresponding to each color is as shown on Figure 2-1. For the analysis studies, the model is supported at the base ring of the support skirt, and the following loadings are applied:

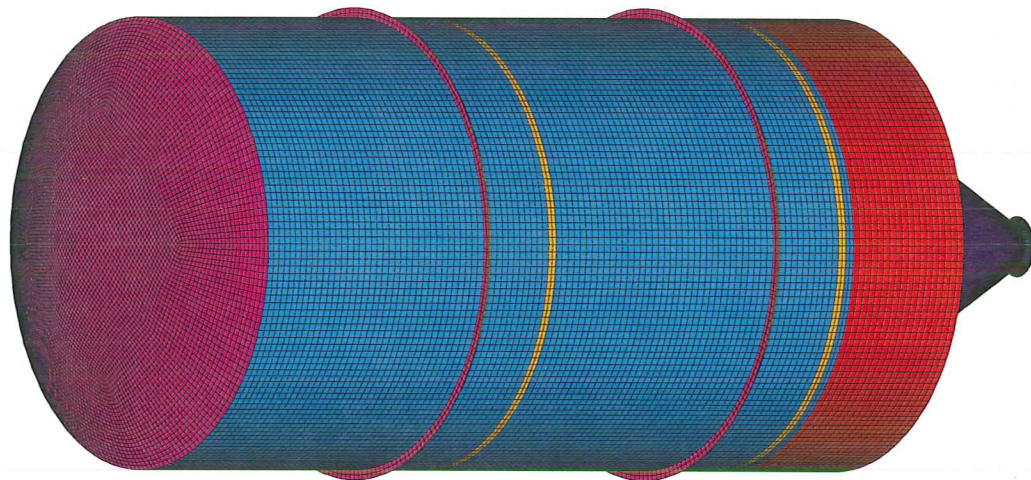
- 1) Weight (tank + contents) + Hydrostatic Pressure
- 2) Weight + Hydro Pressure + Wind
- 3) Weight + Hydro Pressure + Seismic

The weight/hydrostatic pressure load is conservatively based on a slurry level 14.5" below the top of the cylinder. As shown on Figure 2-1, this level includes the top 39.5" of water only. The hydrostatic pressure is based on a specific gravity of 1.5.

The wind and seismic loadings are based on IBC 2012. The detailed calculations are provided in Appendix A. The wind loading is based on the IBC design minimum pressure of 16 psf. This pressure loading is applied to all exposed surfaces of the tank and skirt. The calculated seismic loads of 0.185 g's horizontal and 0.049 vertical are applied as static g loads. A modal analysis is performed to verify that no additional wind or seismic analysis is required. The finite element analysis results are presented and evaluated in Section 4.0.

```
ANSYS 11.0SP1
JUL 21 2011
17:47:43
PLOT NO.      1
ELEMENTS
REAL NUM

XV  =1
YV  =1
ZV  =1
DIST=193.383
YF  =153.022
PRECISE HIDDEN
```



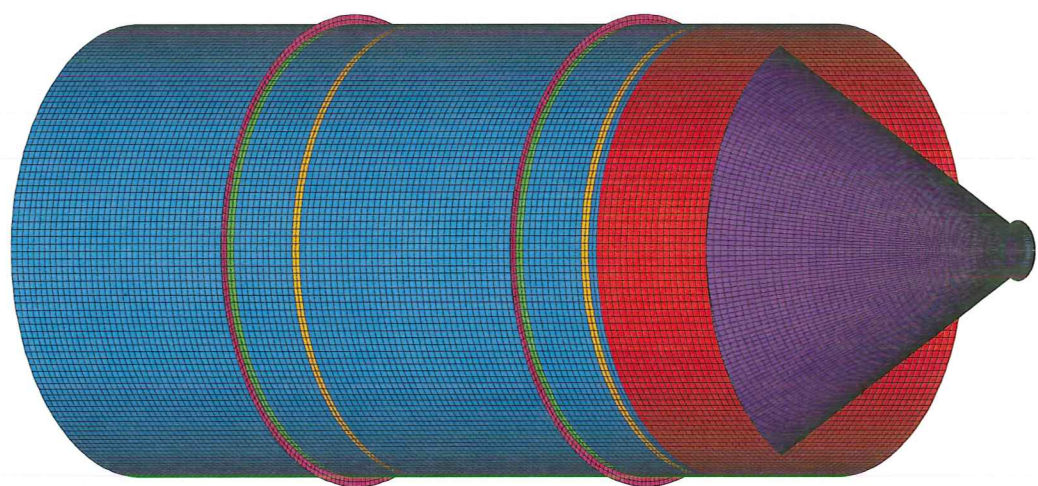
CBE 11 001 Shell Model (CBE Vessel):

Figure 3-1 - ANSYS Finite Element Model of Storage Tank

1

```
ANSYS 11.0SP1
JUL 21 2011
17:47:48
PLOT NO.      5
ELEMENTS
REAL NUM

XV  =1
YV  =-1
ZV  =1
DIST=193.383
YF  =153.022
PRECISE HIDDEN
```

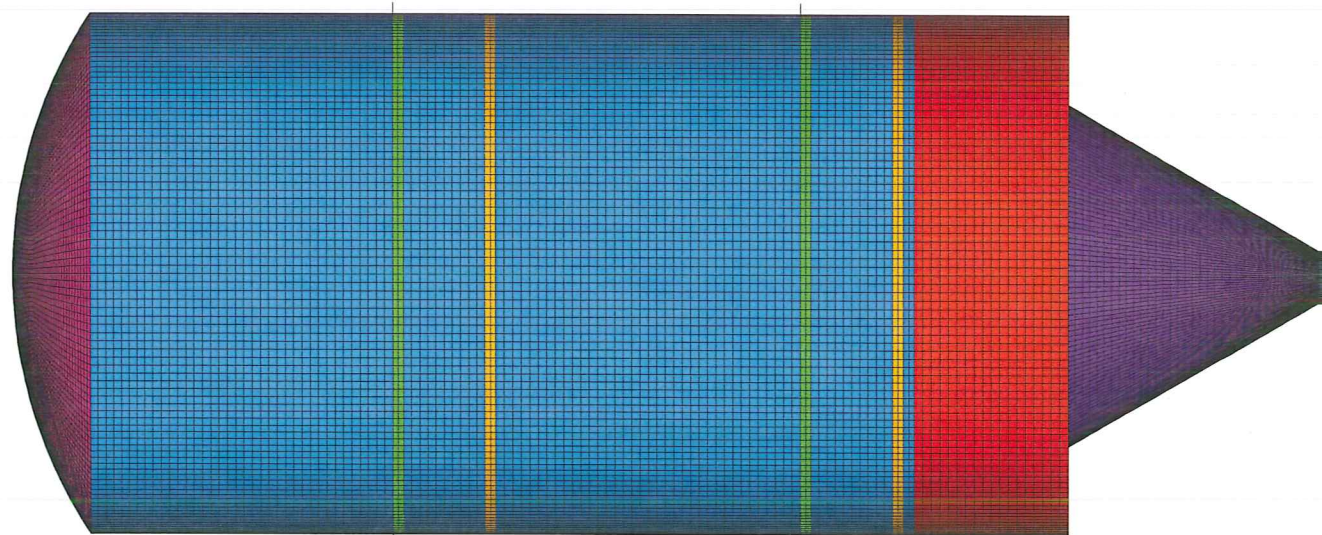


CBE 11 001 Shell Model (CBE Vessel) :

Figure 3-2 - ANSYS Finite Element Model of Storage Tank

```
ANSYS 11.0SP1
JUL 21 2011
17:47:45
PLOT NO.      3
ELEMENTS
REAL NUM

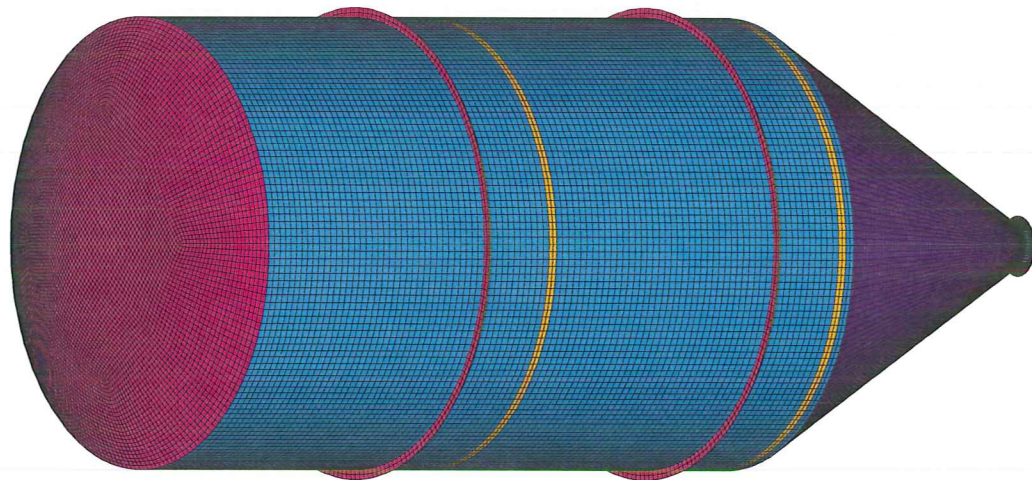
ZV  =1
DIST=168.186
YF  =153.022
PRECISE HIDDEN
```



CBE 11 001 Shell Model (CBE Vessel):)

Figure 3-3 - ANSYS Finite Element Model of Storage Tank

```
ANSYS 11.0SP1
JUL 21 2011
17:47:44
PLOT NO.      2
ELEMENTS
REAL NUM
XV  =1
YV  =1
ZV  =1
DIST=193.383
YF  =153.022
PRECISE HIDDEN
```

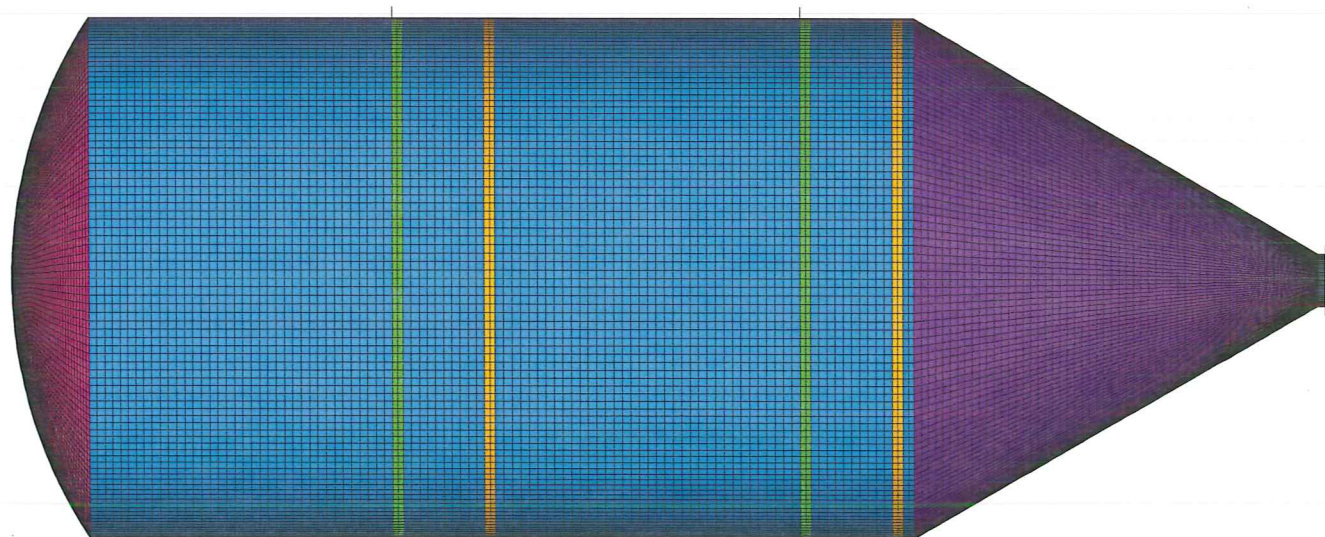


CBE 11 001 Shell Model (CBE Vessel) :

Figure 3-4 - ANSYS Finite Element Model of Storage Tank (Support Skirt Removed to Show Cone)

ANSYS 11.0SP1
JUL 21 2011
17:47:47
PLOT NO. 4
ELEMENTS
REAL NUM

ZV =1
DIST=168.186
YF =153.022
PRECISE HIDDEN



CBE 11 001 Shell Model (CBE Vessel):

Figure 3-5 - ANSYS Finite Element Model of Storage Tank (Support Skirt Removed to Show Cone)

REPORT NO. DEAC-TR-1473	REV. NO.	PROJECT NO. CBE-11-001	PAGE 11
----------------------------	----------	---------------------------	-------------------

4.0 FEA RESULTS AND EVALUATION PER AWWA D100-05

The ANSYS finite element model described in Section 3.0 was used to perform both modal and stress analyses. Modal analyses were performed for both the empty tank and full tank conditions. Figure 4-1 shows the mode shape and frequency of the fundamental tank mode for the empty vessel condition. The natural frequency for the empty tank, shown as "FREQ=" in the plot legend, is 55.7 Hz. The fundamental mode shape plot for the full tank case, with a frequency of 12.2 Hz, is shown on Figure 4-2. These calculated natural frequencies agree very closely with the PV Elite calculation in Appendix B, and present no special problems in terms of either wind or seismic loadings.

Figures 4-3, 4-4 and 4-5 show maximum principal stress, minimum principal stress and Von Mises equivalent stress contours for the operating case, consisting of weight plus hydrostatic pressure with the tank full. The highest tensile stress (max principal stress) of 4.412 ksi is well below the AWWA allowable of .85 x 15 ksi = 12.75 ksi. The highest compressive stress, shown on the min principal stress plot (Figure 4-4) is 6.13 ksi. This is basically a very localized compressive hoop stress at the cone/cylinder intersection, due to the hydrostatic pressure loading. Table 4-1, taken from AWWA D100-05 shows the allowable local buckling compressive stress as a function of the thickness/radius ratio. For the tank t/r ratio of 0.0029, the allowable compressive stress is 7.209 ksi. The calculated stress of 6.13 ksi is below the applicable stress limit.

Figure 4-6 shows the axial stress contours due to the applied horizontal and vertical seismic loadings. The seismic loads produce a relatively low overall bending stress of 0.988 ksi. Figures 4-7, 4-8 and 4-9 show the maximum principal stress, minimum principal stress and Von Mises equivalent stress for the combination of operating (weight + hydrostatic pressure, full vessel) and seismic loading on the full tank. The maximum tension and compression stresses of 4.436 ksi and 6.418 ksi are only slightly higher than the stresses for the operating case. Since the allowables for the wind and seismic cases are increased by 33%, the seismic stresses easily satisfy the allowables.

DESIGN ENGINEERING ANALYSIS CORPORATION



REPORT NO. DEAC-TR-1473	REV. NO.	PROJECT NO. CBE-11-001	PAGE 12
----------------------------	----------	---------------------------	-------------------

The maximum principal stress, minimum principal stress and Von Mises equivalent stress for the operating + wind loading are shown on Figures 4-10, 4-11 and 4-12. The stresses due to wind loading are lower than the seismic stresses and easily satisfy the AWWA allowables.

It is concluded, based on the detailed finite element analysis results for the thickness data provided, that the T1, T2, T5 and T6 tanks are acceptable for continued atmospheric storage of the slurry.

As an additional check on the tanks, an ASME PV Code Section VIII analysis is performed as outlined in the following section.

TABLE 4-1
ALLOWABLE LOCAL COMPRESSIVE STRESS - FROM AWWA D-100-05

WELDED CARBON STEEL TANKS FOR WATER STORAGE 29

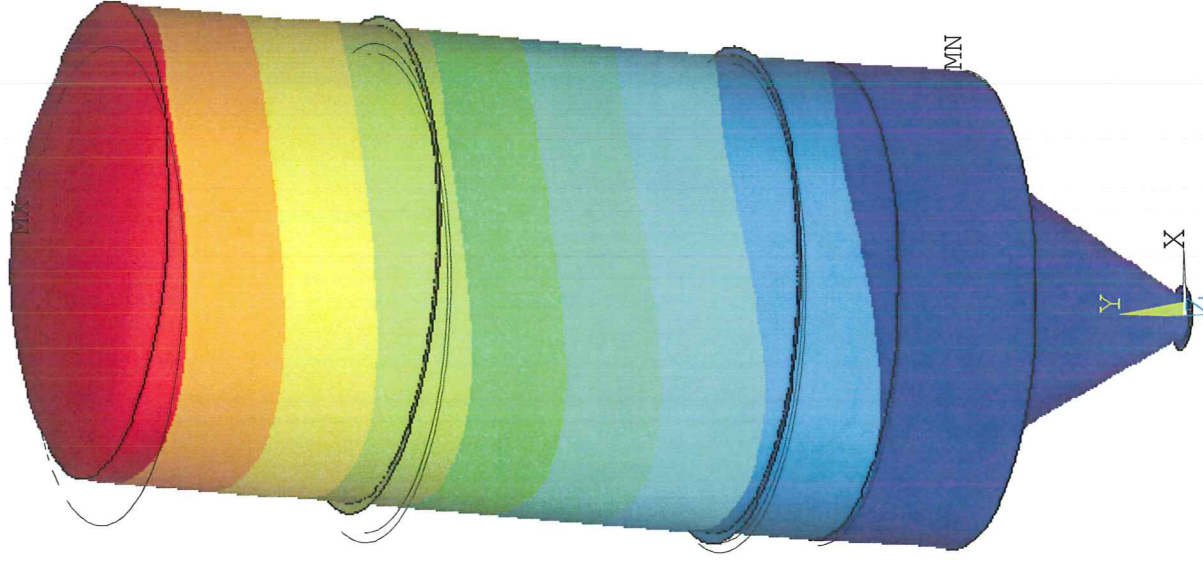
Table 10 Allowable local buckling compressive stress F_L for class 1 materials

t/R	F_L (psi)	F_L (MPa)	t/R	F_L (psi)	F_L (MPa)	t/R	F_L (psi)	F_L (MPa)
0.0001	175	1.2	0.0043	8,943	61.7	0.0085	12,048	83.1
0.0002	351	2.4	0.0044	9,022	62.2	0.0086	12,122	83.6
0.0003	527	3.6	0.0045	9,096	62.7	0.0087	12,196	84.1
0.0004	706	4.9	0.0046	9,170	63.2	0.0088	12,259	84.6
0.0005	888	6.1	0.0047	9,244	63.7	0.0089	12,343	85.1
0.0006	1,069	7.4	0.0048	9,317	64.3	0.0090	12,417	85.6
0.0007	1,255	8.7	0.0049	9,391	64.8	0.0091	12,491	86.1
0.0008	1,445	10.0	0.0050	9,465	65.3	0.0092	12,565	86.7
0.0009	1,639	11.3	0.0051	9,539	65.8	0.0093	12,638	87.2
0.0010	1,838	12.7	0.0052	9,613	66.3	0.0094	12,712	87.7
0.0011	2,041	14.1	0.0053	9,686	66.8	0.0095	12,786	88.2
0.0012	2,251	15.5	0.0054	9,760	67.3	0.0096	12,860	88.7
0.0013	2,467	17.0	0.0055	9,834	67.8	0.0097	12,934	89.2
0.0014	2,690	18.6	0.0056	9,908	68.3	0.0098	13,007	89.7
0.0015	2,920	20.1	0.0057	9,982	68.8	0.0099	13,081	90.2
0.0016	3,158	21.3	0.0058	10,055	69.3	0.0100	13,155	90.7
0.0017	3,405	23.5	0.0059	10,129	69.9	0.0101	13,229	91.2
0.0018	3,660	25.2	0.0060	10,203	70.4	0.0102	13,303	91.7
0.0019	3,925	27.1	0.0061	10,277	70.9	0.0103	13,376	92.3
0.0020	4,200	29.0	0.0062	10,351	71.4	0.0104	13,450	92.8
0.0021	4,485	30.9	0.0063	10,424	71.9	0.0105	13,524	93.3
0.0022	4,782	33.0	0.0064	10,498	72.4	0.0106	13,598	93.8
0.0023	5,090	35.1	0.0065	10,572	72.9	0.0107	13,672	94.3
0.0024	5,410	37.3	0.0066	10,646	73.4	0.0108	13,745	94.8
0.0025	5,742	39.6	0.0067	10,720	73.9	0.0109	13,819	95.3
0.0026	6,088	42.0	0.0068	10,793	74.4	0.0110	13,893	95.8
0.0027	6,447	44.5	0.0069	10,887	74.9	0.0111	13,967	96.3
0.0028	6,821	47.0	0.0070	10,941	75.5	0.0112	14,041	96.8
0.0029	7,209	49.7	0.0071	11,015	76.0	0.0113	14,114	97.3
0.0030	7,612	52.5	0.0072	11,089	76.5	0.0114	14,188	97.8
0.0031	8,032	55.4	0.0073	11,152	77.0	0.0115	14,262	98.4
0.0032	8,137	56.1	0.0074	11,236	77.5	0.0116	14,336	98.9
0.0033	8,210	56.6	0.0075	11,310	78.0	0.0117	14,410	99.4
0.0034	8,284	57.1	0.0076	11,384	78.5	0.0118	14,483	99.9
0.0035	8,358	57.5	0.0077	11,453	79.0	0.0119	14,557	100.4
0.0036	8,432	58.2	0.0078	11,531	79.5	0.0120	14,631	100.9
0.0037	8,505	58.7	0.0079	11,585	80.0	0.0121	14,705	101.4
0.0038	8,579	59.2	0.0080	11,679	80.5	0.0122	14,779	101.9
0.0039	8,653	59.7	0.0081	11,753	81.1	0.0123	14,852	102.4
0.0040	8,727	60.2	0.0082	11,827	81.5	0.0124	14,926	102.9
0.0041	8,801	60.7	0.0083	11,900	82.1	0.0125	15,000	103.4
0.0042	8,875	61.2	0.0084	11,974	82.5	>0.0125	15,000	103.4

```

ANSYS 12.1
JUL 22 2011
10:28:29
PLOT NO. 1
NODAL SOLUTION
STEP=1
SUB =19
FREQ=55.743
USUM (AVG)
RSYS=0
PowerGraphics
EFACET=1
AVRES=Mat
DMX =.471306
SMX =.471306
0
.052367
.104735
.157102
.209469
.261836
.314204
.366571
.418938
.471306

```



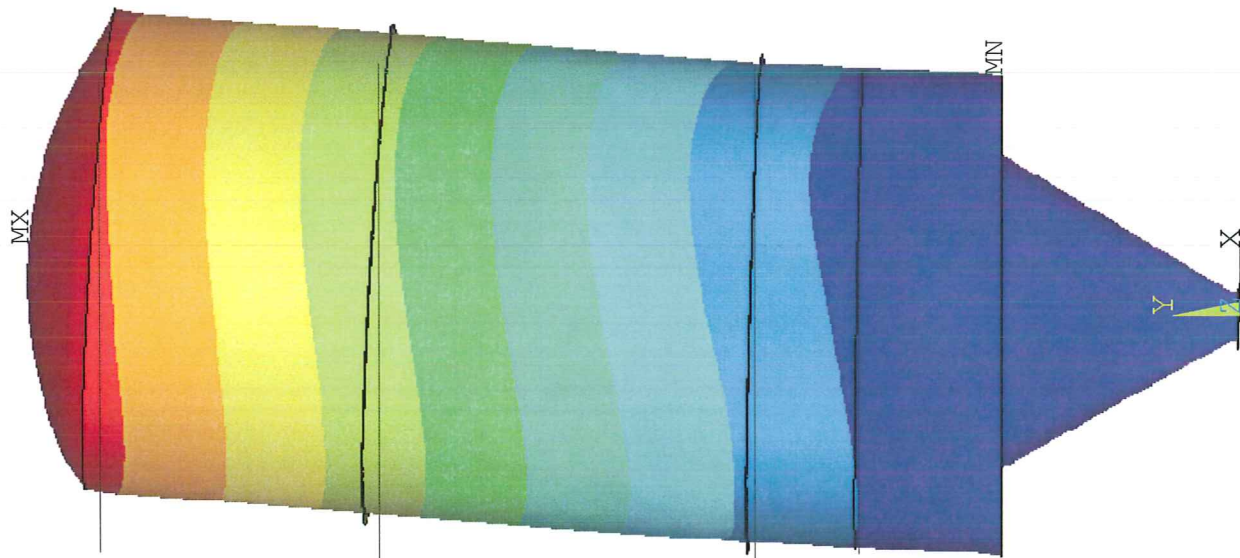
CBE 11 001 (CBE_vessel_empty_modal):

Figure 4-1 - Mode Shape Plot for Fundamental Tank Rocking Mode, Empty - $f = 55.7$ Hz

```

ANSYS 12.1
JUL 22 2011
10:19:16
PLOT NO. 1
NODAL SOLUTION
STEP=1
SUB =19
FREQ=12.159
USUM (AVG)
RSYS=0
PowerGraphics
EFACET=1
AVRES=Mat
DMX =.102806
SMX =.102806
0
.011423
.022846
.034269
.045692
.057115
.068537
.07996
.091383
.102806

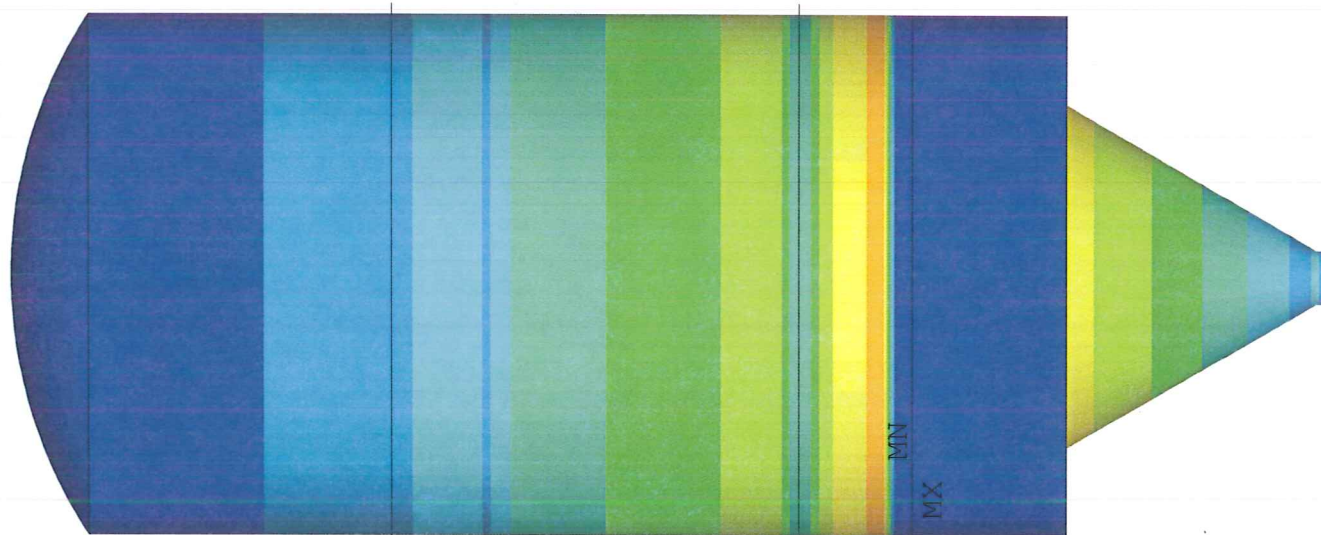
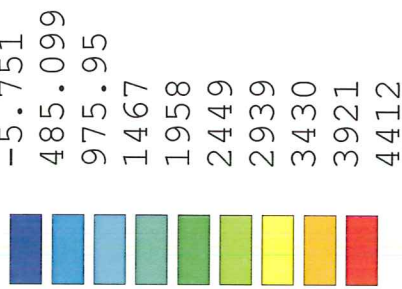
```



CBE 11 001 (CBE_vessel_full_modal):

Figure 4-2 - Mode Shape Plot for Fundamental Tank Rocking Mode, Full - $f = 12.2$ Hz

ANSYS 12.1
 JUL 14 2011
 17:35:13
 PLOT NO. 4
 NODAL SOLUTION
 STEP=1
 SUB =1
 TIME=1
 S1 (AVG)
 MIDDLE
 DMX =.01509
 SMN =-5.751
 SMX =4412



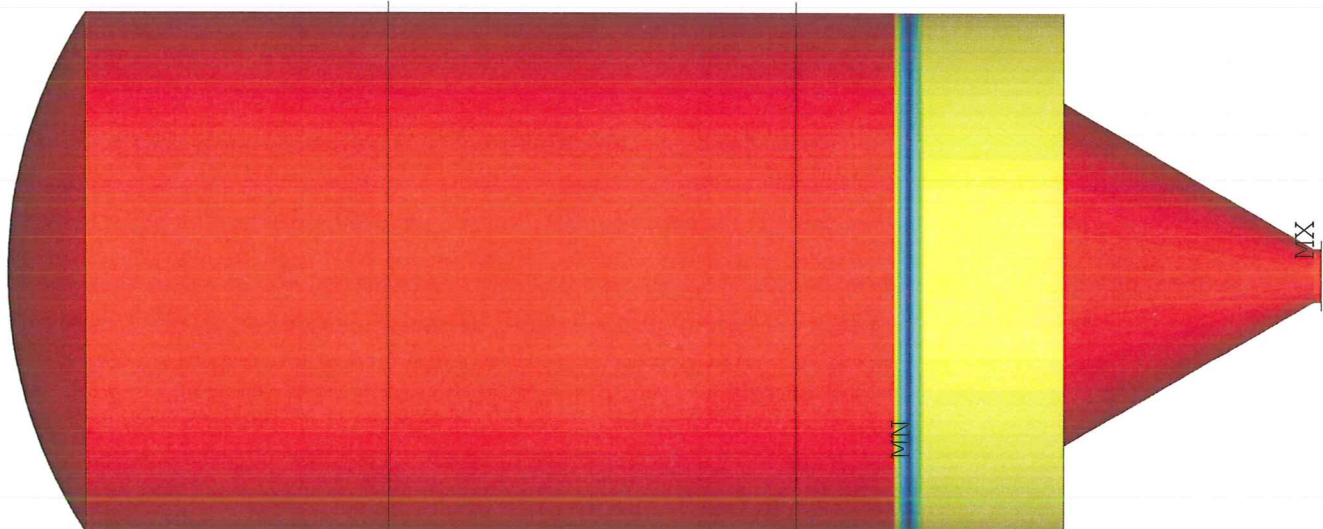
CBE 11 001 Shell Model (CBE Vessel): Max Principal stress

Figure 4-3 - Max Principal Stress for Operating Case - Weight + Hydrostatic Pressure (Full)

```

ANSYS 12.1
JUL 14 2011
17:35:15
PLOT NO. 5
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
S3 (AVG)
MIDDLE
RSYS=0
DMX =.01509
SMN =-6126
SMX =31.487

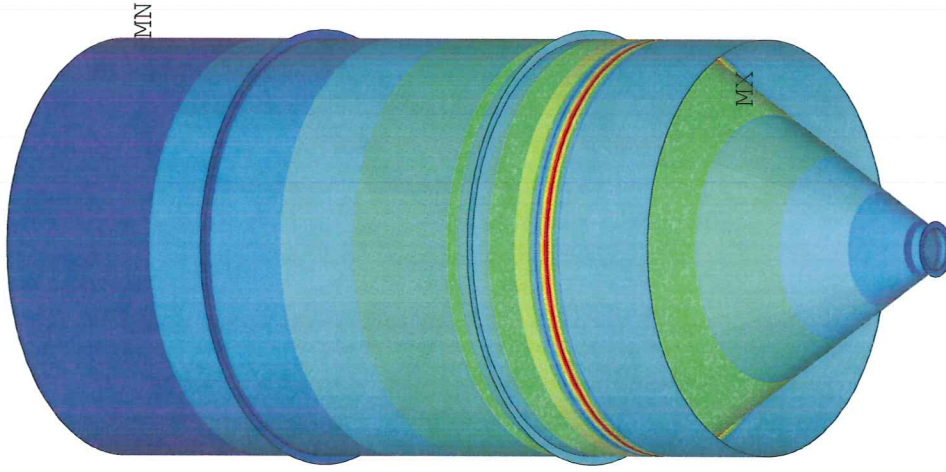
```



CBE 11 001 Shell Model (CBE Vessel): Min Principal stress

Figure 4-4 - Min Principal Stress for Operating Case - Weight + Hydrostatic Pressure (Full)

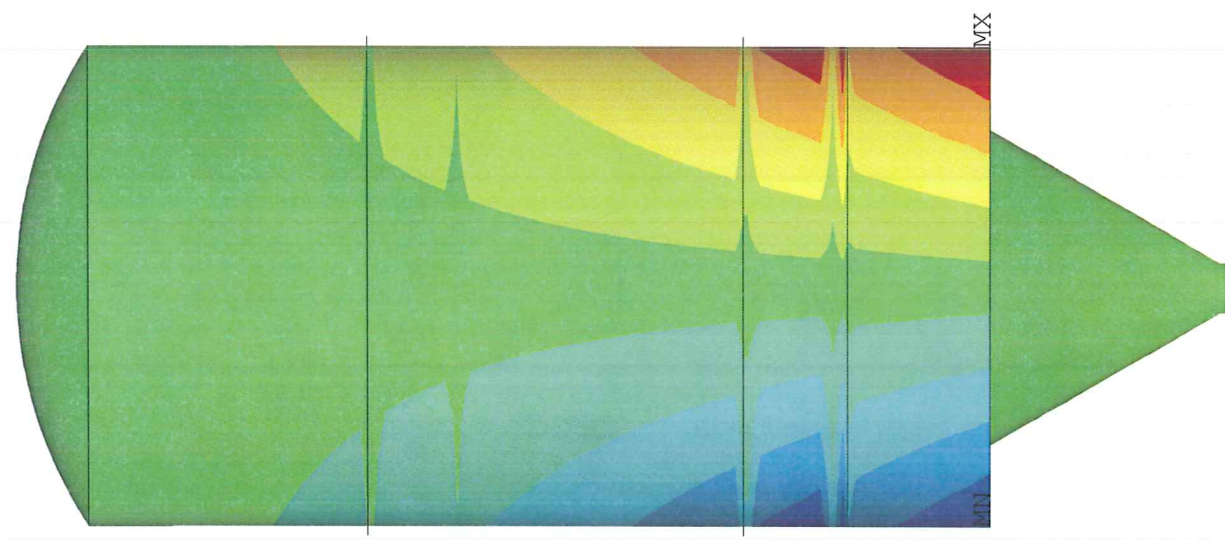
ANSYS 11.0SP1
JUL 21 2011
17:47:59
PLOT NO. 12
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SEQV (AVG)
MIDDLE
DMX =.01509
SMN =10.934
SMX =6055
10.934
682.471
1354
2026
2697
3369
4040
4712
5383
6055



CBE 11 001 Shell Model (CBE Vessel): von mises stress

Figure 4-5 - Von Mises Equivalent Stress for Operating Case - Weight + Hydrostatic Pressure (Full)

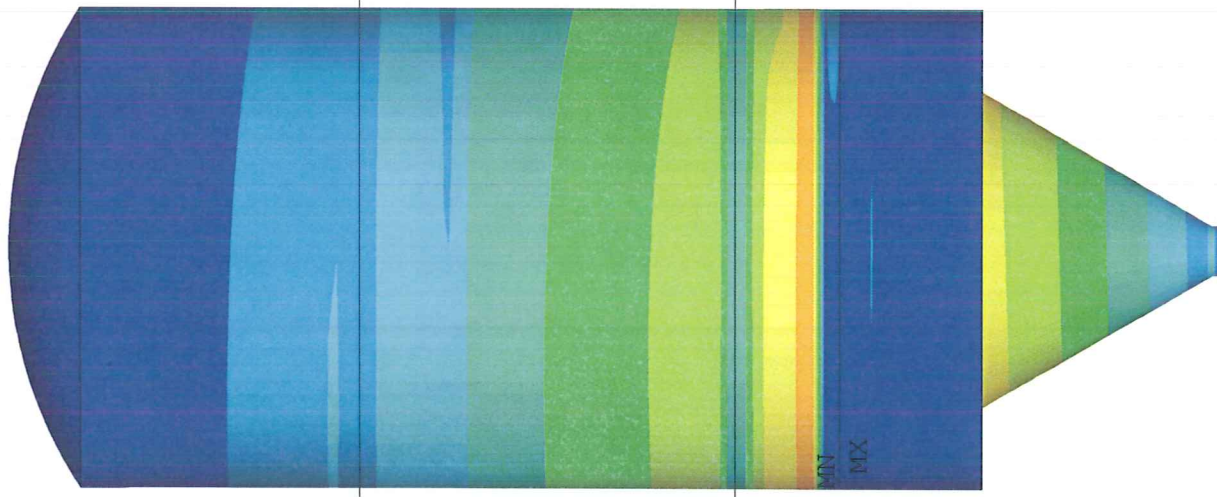
ANSYS 12.1
JUL 21 2011
15:23:48
PLOT NO. 3
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SY (AVG)
MIDDLE
RSYS=0
DMX =.016957
SMN =-988.049
SMX =988.049
-988.049
-768.482
-548.916
-329.35
-109.783
109.783
329.35
548.916
768.482
988.049



Full model (Seismic Load): Axial stress

Figure 4-6 - Axial Stress Due to Seismic Loading

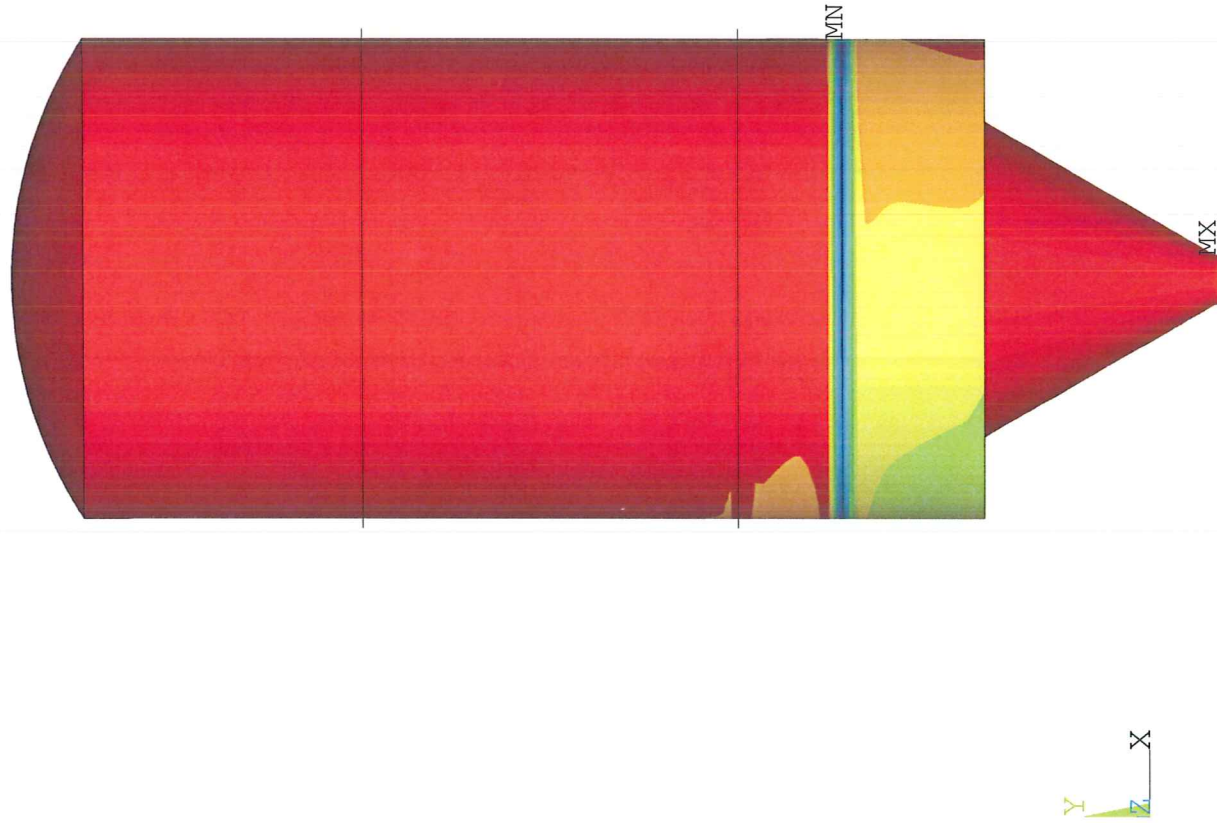
ANSYS 11.0SP1
 AUG 24 2011
 10:19:25
 PLOT NO. 7
 NODAL SOLUTION
 STEP=1
 SUB =1
 TIME=1
 S1 (AVG)
 MIDDLE
 DMX =.017784
 SMN =-6.014
 SMX =4436
 -6.014
 487.591
 981.196
 1475
 1968
 2462
 2956
 3449
 3943
 4436



CBE 11 001 Shell Model (Seismic Load): Max Principal stress

Figure 4-7 - Max Principal Stress Due to Operating (Weight + Hydrostatic Pressure) and Seismic Loading (Full)

ANSYS 11.0SP1
AUG 24 2011
10:19:28
PLOT NO. 8
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
S3 (AVG)
MIDDLE
RSYS=0
DMX =.017784
SMN =-6418
SMX =31.547
-6418
-5701
-4985
-4268
-3552
-2835
-2118
-1402
-685.07
31.547

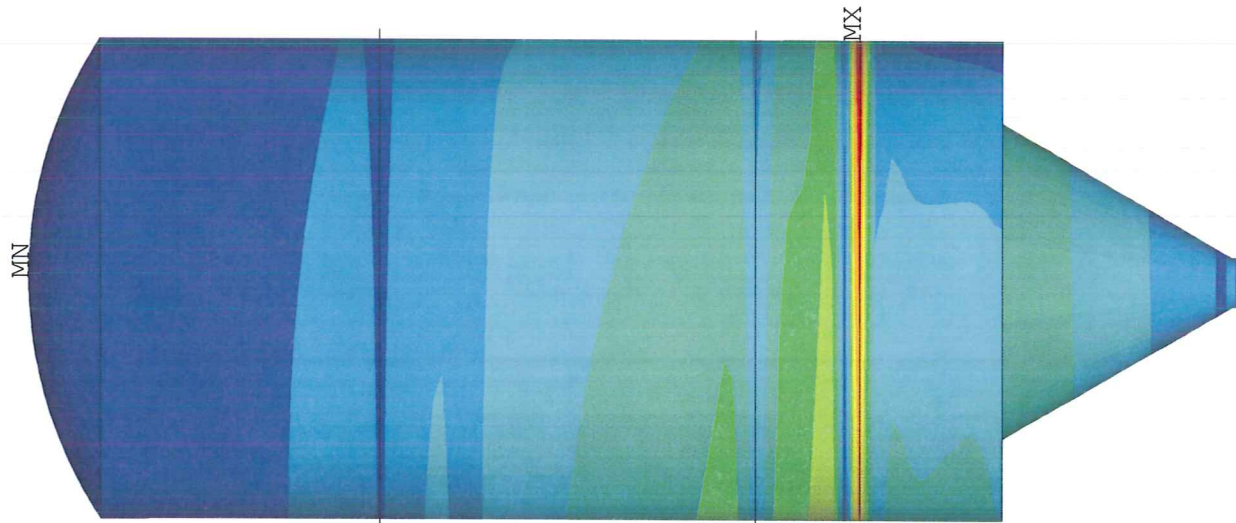


CBE 11 001 Shell Model (Seismic Load): Min Principal stress

Figure 4-8 - Min Principal Stress Due to Operating (Weight + Hydrostatic Pressure) and Seismic Loading (Full)

1

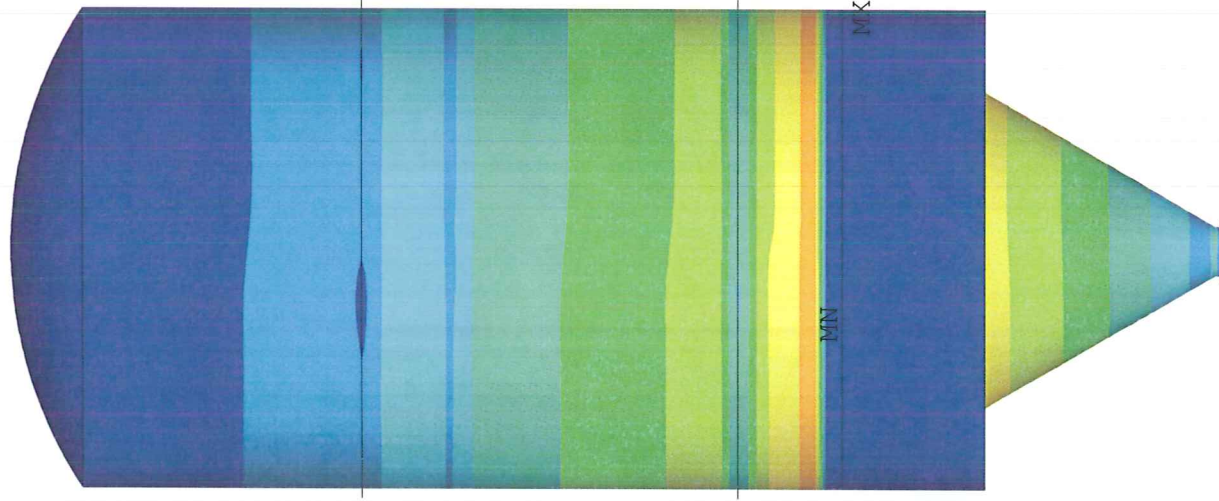
ANSYS 11.0SP1
AUG 24 2011
10:19:22
PLOT NO. 6
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SEQV (AVG)
MIDDLE
DMX =.017784
SMN =.014954
SMX =6633
 .014954
736.992
1474
2211
2948
3685
4422
5159
5896
6633



CBE 11 001 Shell Model (Seismic Load): von mises stress

Figure 4-9 - Von Mises Equivalent Stress Due to Operating (Weight + Hydrostatic Pressure) and Seismic Loading (Full)

ANSYS 12.1
 JUL 20 2011
 16:39:09
 PLOT NO. 7
 NODAL SOLUTION
 STEP=1
 SUB =1
 TIME=1
 S1 (AVG)
 MIDDLE
 DMX =.015831
 SMN =-5.917
 SMX =4415
 -5.917
 485.339
 976.595
 1468
 1959
 2450
 2942
 3433
 3924
 4415

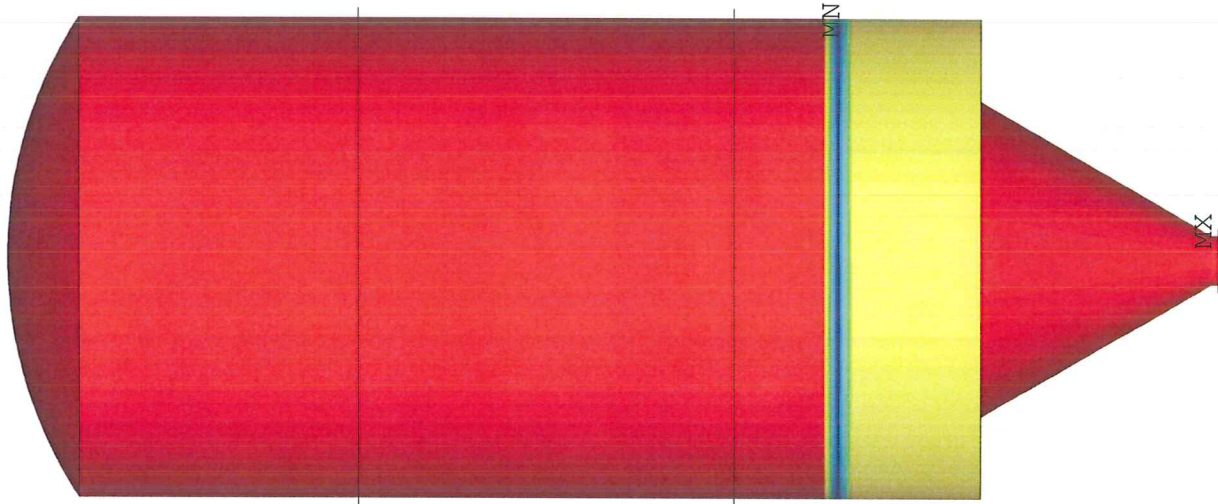


CBE 11 001 Shell Model (Wind Load): Max Principal stress

Figure 4-10 - Max Principal Stress Due to Operating (Full Weight + Hydrostatic Pressure) + Wind Loading

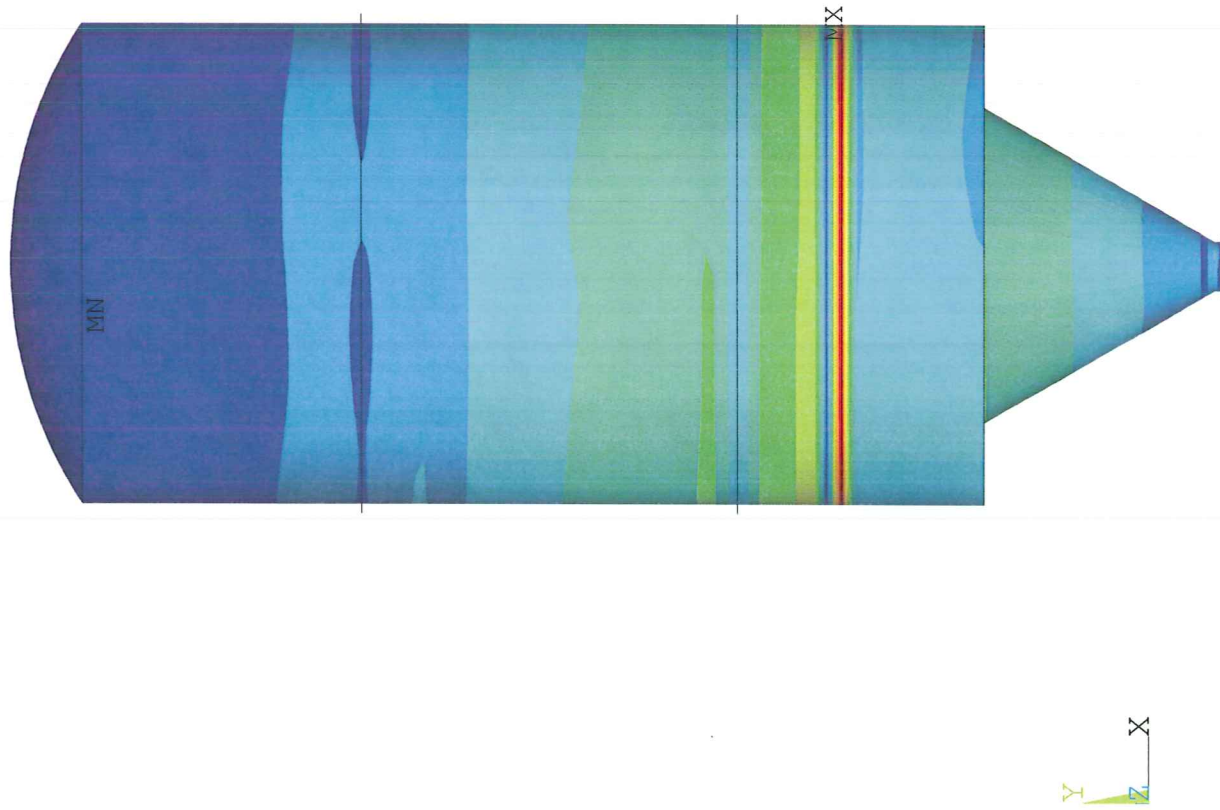
1

```
ANSYS 12.1
JUL 20 2011
16:39:11
PLOT NO.      8
NODAL SOLUTION
STEP=1
SUB  =1
TIME=1
S3              (AVG)
MIDDLE
RSYS=0
DMX  =.015831
SMN  =-6172
SMX  =36.789
-6172
-5483
-4793
-4103
-3413
-2723
-2033
-1343
-653.127
36.789
```



CBE 11 001 Shell Model (Wind Load): Min Principal stress

Figure 4-11 - Min Principal Stress Due to Operating (Full Weight + Hydrostatic Pressure) + Wind Loading



CBE 11 001 Shell Model (Wind Load): von mises stress

Figure 4-12 - Von Mises Equivalent Stress Due to Operating (Full Weight + Hydrostatic Pressure) + Wind Loading

ANSYS 12.1
 JUL 20 2011
 16:39:08
 PLOT NO. 6
 NODAL SOLUTION
 STEP=1
 SUB =1
 TIME=1
 SEQV (AVG)
 MIDDLE
 DMX =.015831
 SMN =2.87
 SMX =6125



REPORT NO. DEAC-TR-1473	REV. NO.	PROJECT NO. CBE-11-001	PAGE 26
----------------------------	----------	---------------------------	------------

5.0 ASME SECTION VIII, DIV. 1 CODE CALCS

The finite element analysis in the previous section demonstrated that, with the thickness data provided, the calculated stresses in the tank and support skirt due to operating, seismic and wind loadings satisfy the stress limits from AWWA D100-05. As an additional check on the integrity of the tanks, an ASME PV Code Section VIII analysis is performed using the PV Elite software package (Reference 4).

The scope of the ASME Code is limited to pressure vessels with a design pressure of 15 psig or greater. For the Code calculations, an internal pressure of 15 psig was specified, along with the hydrostatic pressure of the 1.5 SG contents at the water-only fill level.

The complete PV Elite report is included in Appendix B. The calculated frequencies for the empty and full tank are in very close agreement with the FEA results. The report shows that specified tank thicknesses satisfy the Code requirements, confirming the conclusions of the FEA study. Once again, it is concluded that, based on the thickness data provided, the tanks are acceptable for continued atmospheric storage of the slurry.

DESIGN ENGINEERING ANALYSIS CORPORATION



REPORT NO. DEAC-TR-1473	REV. NO.	PROJECT NO. CBE-11-001	PAGE 27
----------------------------	----------	---------------------------	------------

6.0 REFERENCES

1. International Building Code, 2012 Edition, International Code Council.
2. AWWA Standard D100-05, "Welded Carbon Steel Tanks for Water Storage," American Water Works Association, Denver, CO.
3. ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, 2010 Edition.
4. PV Elite 2011, Intergraph CADWorx and Analysis Solutions, Inc., Houston, TX 77070.
5. ANSYS Finite Element Program, Release 12.1, ANSYS Inc., Southpointe, 275 Technology Drive, Canonsburg, PA 15317.

REPORT NO. DEAC-TR-1473	REV. NO.	PROJECT NO. CBE-11-001	PAGE 28
----------------------------	----------	---------------------------	------------

APPENDIX A

Wind and Seismic Loads

per IBC 2012

Wind Load Calculations per IBC 2012 & ASCE 7-10
Project: CBE-11-001

as of 07/20/11

D = 10.00 ft (outside diameter)
C_f = 0.70 Force Coefficient (Figure 29.5-1)
K_d = 0.95 Directionality Factor (Table 26.6-1)
K_{zt} = 1.00 Para.26.8.2 (minimum value shall be 1.00)
Category = I
Exposure = C
Velocity = 105 mph (Ultimate Wind Speed)
Velocity = 81 mph (Design Wind Speed - Eqn 16-33)
G = 0.85 Gust Effect Factor (Para 26.9-1)

TABLE 29.3-1

z (ft)	Velocity Pressure Exposure Coefficients K _z			Velocity Pressure q _z (psf)	Wind Pressure q _z GC _f (psf)	D√q _z (Figure 29.5-1)
	B	C	D			
0-15	0.57	0.85	1.03	16.00	9.52	40.00
20	0.62	0.90	1.08	16.00	9.52	40.00
25	0.66	0.94	1.12	16.00	9.52	40.00
30	0.70	0.98	1.16	16.00	9.52	40.00
40	0.76	1.04	1.22	16.59	9.87	40.74
50	0.81	1.09	1.27	17.39	10.35	41.70
60	0.85	1.13	1.31	18.03	10.73	42.46
70	0.89	1.17	1.34	18.67	11.11	43.21
80	0.93	1.21	1.38	19.31	11.49	43.94

- Notes:
1. z is height above ground level (ft)
 2. $q_z = 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot V^2$ (psf) - Eqn 29.3-1
 3. Minimum design pressure shall not be less than 16 psf (Para 29.8)
 4. References are from ASCE 7-10 unless noted.

Static Seismic Factor per IBC 2012

Note: Table & Equation references on this page are taken from IBC 2012 Edition

Site Class = D	Per Section 1613.3.2 for unknown soil properties
$S_s := 0.23 \cdot g$	Values from "Structural Calculations ... Double Wall SS304 Carbon Filter Tank..."
$S_1 := 0.15 \cdot g$	

Risk Category = II

Table 1604.5 (Other structures)

From Section 1613:

$F_a := 1.6$ Table 1613.3.3(1)

$S_{MS} := F_a \cdot S_s$ $S_{MS} = 0.368$ (Equation 16-37)

$S_{DS} := \frac{2}{3} \cdot S_{MS}$ $S_{DS} = 0.245$ (Equation 16-39)

Seismic Design Category = B ($0.167g \leq S_{DS} < 0.33g$) Table 1613.3.5(1)

$F_v := 2.2$ Table 1613.3.3(2)

$S_{M1} := F_v \cdot S_1$ $S_{M1} = 0.330$ (Equation 16-39)

$S_{D1} := \frac{2}{3} \cdot S_{M1}$ $S_{D1} = 0.220$ (Equation 16-40)

Seismic Design Category = D ($S_{D1} > 0.20g$) Table 1616.3(2)

Static Seismic Factor per IBC 2012

Note: Table & Equation references on this page are taken from ASCE 7-10 Edition

$a_p := 2.50$		Table 13.6-1 (skirt-supported vessel)
$R_p := 2.50$		
$I_p := 1.0$		Section 13.1.3
$S_{DS} = 0.245$		S_{DS} calculated with IBC 2012 as shown above
let $z_0 := 10 \cdot \text{ft}$		Assumed elevation of skirt base relative to grade
let $z := 5 \cdot \text{ft} + z_0$		Height of skirt base relative to base of vessel
let $h := 24 \cdot \text{ft} + z_0$		Height of vessel relative to base of vessel
$\frac{z}{h} = 0.441$		Term used in Equation 13.3-1
$F_{p1} := \frac{0.4 \cdot a_p \cdot S_{DS} \cdot W_p}{\frac{R_p}{I_p}} \cdot \left(1 + 2 \cdot \frac{z}{h}\right)$	$F_{p1} = 0.185 \cdot W_p$	(Equation 13.3-1)
$F_{p2} := 1.6 \cdot S_{DS} \cdot I_p \cdot W_p$	$F_{p2} = 0.393 \cdot W_p$	Upper bound on seismic force (Equation 13.3-2)
$F_{p3} := 0.3 \cdot S_{DS} \cdot I_p \cdot W_p$	$F_{p3} = 0.074 \cdot W_p$	Lower bound on seismic force (Equation 13.3-3)
$F_p := \max(\min(F_{p1}, F_{p2}), F_{p3})$	$F_p = 0.185 \cdot W_p$	Horizontal seismic design force

The total seismic load effect also includes a vertical component to be applied concurrently (Section 13.3.1):

$0.2 \cdot S_{DS} \cdot W_p = 0.049 \cdot W_p$	Vertical seismic design force (plus or minus)
--	---

Conclusion: The structure will be analyzed with static seismic loads as shown above.

REPORT NO. DEAC-TR-1473	REV. NO.	PROJECT NO. CBE-11-001	PAGE 33
----------------------------	----------	---------------------------	------------

APPENDIX B

PV Elite Report for

ASME Code Calcs

Table of Contents

Cover Sheet	
Shell Analysis	: Top Head
Shell Analysis	: Cylinder
Conical Analysis	: Lower Cone
Vessel Results	Summary
 2
 7
 10
 17

Cover Page

DESIGN CALCULATION

ASME Code Version : 2010

Analysis Performed by : DESIGN ENGINEERING ANALYSIS CORP.

Job File : F:\CBE-11-001\CodeCalc Files\tank T-1(10-03-11).cci

Date of Analysis : Oct 3,2011

PV Elite 2011, January 2011

PV Elite 2011 Licensee: DESIGN ENGINEERING ANALYSIS CORP.

FileName : Tank T-1(10-03-11) -----

Shell Analysis : Top Head

Item: 1 3:55p Oct 3,2011

Input Echo, Component	1,	Description: Top Head
Design Internal Pressure	P	15.00 psig
Temperature for Internal Pressure		150.00 F
Design External Pressure	PEXT	0.50 psig
Temperature for External Pressure		150.00 F
External Pressure Chart Name		HA-1
Include Hydrostatic Head Components		NO
Material Specification		SA-240 304
Material UNS Number		S30400
Material Form used		Plate
Allowable Stress At Temperature	S	20000.00 psi
Allowable Stress At Ambient	SA	20000.00 psi

*** Note: Allowable Stresses Modified as UTS > 70 ksi, per App. 1-4.

Yield Stress At Temperature	Sy	26700.00 psi
Joint efficiency for Head Joint	E	1.00
Inside Diameter of Torispherical Head	D	120.000 in.
Minimum Thickness of Pipe or Plate	T	0.1830 in.
Shell/Head Int. Corrosion Allowance	CA	0.0000 in.
Inside Crown Radius of Tori. Head	L	120.000 in.
Inside Knuckle Radius of Tori. Head	r	7.500 in.
Length of Straight Flange	STRNFLG	1.5000 in.
Skip UG-16(b) Min. thickness calculation		NO
Type of Element:		Torispherical Head

Internal pressure results, Shell Number 1, Desc.: Top Head

ASME Code, Section VIII, Division 1, 2010

M factor for Torispherical Heads [M]:

$$\begin{aligned}
 &= (3 + \sqrt{(L+CA)/(r+CA)}) / 4 \text{ per Appendix 1-4 (b \& d)} \\
 &= (3 + \sqrt{(120.000 + 0.0000) / (7.500 + 0.0000)}) / 4 \\
 &= 1.7500
 \end{aligned}$$

Thickness Due to Internal Pressure (Tr):

$$\begin{aligned}
 &= (P * (L+CA) * M) / (2 * S * E - 0.2 * P) \text{ per Appendix 1-4(d)} \\
 &= (15.00 * (120.0000 + 0.0000) * 1.7500) / (2 * 20000.00 * 1.00 - 0.2 * 15.00) \\
 &= 0.0788 + 0.0000 = 0.0788 \text{ in.}
 \end{aligned}$$

Max. All. Working Pressure at Given Thickness (MAWP):

$$\begin{aligned}
 &= (2 * S * E * (T - CA - CAE)) / (M * (L + CA) + 0.2 * (T - CA - CAE)) \text{ per Appendix 1-4(d)} \\
 &= (2 * 20000.00 * 1.00 * (0.1830)) / (1.7500 * (120.0000 + 0.0000) + 0.2 * (0.1830)) \\
 &= 34.85 \text{ psig}
 \end{aligned}$$

Maximum Allowable Pressure, New and Cold (MAPNC):

$$\begin{aligned}
 &= (2 * S * E * T) / (M * L + 0.2 * T) \text{ per Appendix 1-4 (d)} \\
 &= (2 * 20000.00 * 1.00 * 0.1830) / (1.7500 * 120.0000 + 0.2 * 0.1830)
 \end{aligned}$$

$$= 34.85 \text{ psig}$$

Actual stress at given pressure and thickness (Sact):

$$\begin{aligned} &= (P * (M * (L + CA) + 0.2 * (T - CA - CAEXT))) / (2 * E * (T - CA - CAEXT)) \\ &= (15.00 * (1.7500 * (120.0000 + 0.0000) + 0.2 * (0.1830))) / (2 * 1.00 * (0.1830)) \\ &= 8608.06 \text{ psi} \end{aligned}$$

Appendix 1-4(f) Calculations (ts/L = 0.00153)

Note: Please check the temperature limit given in Table 1-4.3 of the code.
If the max. design temp. exceeds the temp. limit, see U-2(g).

$$r/D = 0.06250 : C1 = 0.49588 : C2 = 1.25000$$

Required Thickness Calculation:

Final iteration:

Elastic Buckling Stress (Se):

$$\begin{aligned} &= C1 * Et * (ts/r) \\ &= (0.496 * .27808E+08 * 0.018) \\ &= 242601.281 \text{ psi} \end{aligned}$$

$$\begin{aligned} a &= 0.5 * D - r &= 52.500 &\text{ in.} \\ b &= L - r &= 112.500 &\text{ in.} \\ \text{Beta} &= \text{COS}(A/B) &= 1.085 &\text{ rad.} \\ \text{Ph1} &= \text{SQRT}(L * ts) / r &= 0.531 &\text{ rad.} \\ c &= a / \text{COS}(\text{Beta} - \text{Phi}) &= 61.761 &\text{ in.} \\ \text{Re} &= c + r &= 69.261 &\text{ in.} \end{aligned}$$

Buckling Internal Pressure (Pe):

$$\begin{aligned} &= (Se * ts) / (C2 * Re * ((0.5 * Re / r) - 1.0)) \\ &= (242601.3 * 0.132) / (1.250 * 69.261 * ((0.5 * 69.261 / 7.500) - 1.0)) \\ &= 102.215 \text{ psig} \end{aligned}$$

Yield Internal Pressure (Py):

$$\begin{aligned} &= (Sy * ts) / (C2 * Re * ((0.5 * Re / r) - 1.0)) \\ &= (26700.0 * 0.132) / (1.250 * 69.261 * ((0.5 * 69.261 / 7.500) - 1.0)) \\ &= 11.250 \text{ psig} \end{aligned}$$

Knuckle Failure Internal Pressure (Pck):

$$\begin{aligned} &= 2.0 * Py \\ &= 2.0 * 11.250 \\ &= 22.499 \text{ psig} \end{aligned}$$

Allowable Pressure (Pa):

$$\begin{aligned} &= Pck / 1.5 \\ &= 22.499 / 1.5 \\ &= 15.000 \text{ psig} \end{aligned}$$

$$\text{App 1-4(f) Calculated Required Thick. (TR)} : 0.1320 \text{ in.}$$

MAWP Calculation (ts/L = 0.00153)

FileName : Tank T-1(10-03-11)

Shell Analysis : Top Head

Item: 1 3:55p Oct 3,2011

Elastic Buckling Stress (Se):

$$\begin{aligned}
 &= C1 * Et * (ts/r) \\
 &= (0.496 * .27808E+08 * 0.024) \\
 &= 336455.031 \text{ psi}
 \end{aligned}$$

$$\begin{aligned}
 a &= 0.5 * D - r &= 52.500 &\text{ in.} \\
 b &= L - r &= 112.500 &\text{ in.} \\
 \text{Beta} &= \text{COS}(A/B) &= 1.085 &\text{ rad.} \\
 \text{Ph1} &= \text{SQRT}(L*ts) / r &= 0.625 &\text{ rad.} \\
 c &= a / \text{COS}(\text{Beta}-\text{Phi}) &= 58.604 &\text{ in.} \\
 \text{Re} &= c + r &= 66.104 &\text{ in.}
 \end{aligned}$$

Buckling Internal Pressure (Pe):

$$\begin{aligned}
 &= (Se * ts) / (C2 * Re * ((0.5 * Re / r) - 1.0)) \\
 &= (336455.0 * 0.183) / (1.250 * 66.104 * ((0.5 * 66.104 / 7.500) - 1.0)) \\
 &= 218.717 \text{ psig}
 \end{aligned}$$

Yield Internal Pressure (Py):

$$\begin{aligned}
 &= (Sy * ts) / (C2 * Re * ((0.5 * Re / r) - 1.0)) \\
 &= (26700.0 * 0.183) / (1.250 * 66.104 * ((0.5 * 66.104 / 7.500) - 1.0)) \\
 &= 17.357 \text{ psig}
 \end{aligned}$$

Knuckle Failure Internal Pressure (Pck):

$$\begin{aligned}
 &= 2.0 * Py \\
 &= 2.0 * 17.357 \\
 &= 34.713 \text{ psig}
 \end{aligned}$$

Maximum Allowable Working Pressure (MAWP):

$$\begin{aligned}
 &= Pck / 1.5 \\
 &= 34.713 / 1.5 \\
 &= 23.142 \text{ psig}
 \end{aligned}$$

New & Cold Calculation (ts/L = 0.00153)

Elastic Buckling Stress (Se):

$$\begin{aligned}
 &= C1 * Et * (ts/r) \\
 &= (0.496 * .28300E+08 * 0.024) \\
 &= 342411.656 \text{ psi}
 \end{aligned}$$

$$\begin{aligned}
 a &= 0.5 * D - r &= 52.500 &\text{ in.} \\
 b &= L - r &= 112.500 &\text{ in.} \\
 \text{Beta} &= \text{COS}(A/B) &= 1.085 &\text{ rad.} \\
 \text{Ph1} &= \text{SQRT}(L*ts) / r &= 0.625 &\text{ rad.} \\
 c &= a / \text{COS}(\text{Beta}-\text{Phi}) &= 58.604 &\text{ in.} \\
 \text{Re} &= c + r &= 66.104 &\text{ in.}
 \end{aligned}$$

Buckling Internal Pressure (Pe):

$$\begin{aligned}
 &= (Se * ts) / (C2 * Re * ((0.5 * Re / r) - 1.0)) \\
 &= (342411.7 * 0.183) / (1.250 * 66.104 * ((0.5 * 66.104 / 7.500) - 1.0)) \\
 &= 222.589 \text{ psig}
 \end{aligned}$$

Yield Internal Pressure (Py):

$$\begin{aligned}
 &= (Sy * ts) / (C2 * Re * ((0.5 * Re / r) - 1.0)) \\
 &= (30000.0 * 0.183) / (1.250 * 66.104 * ((0.5 * 66.104 / 7.500) - 1.0)) \\
 &= 19.502 \text{ psig}
 \end{aligned}$$

PV Elite 2011 Licensee: DESIGN ENGINEERING ANALYSIS CORP.

FileName : Tank T-1(10-03-11) -----

Shell Analysis : Top Head

Item: 1 3:55p Oct 3,2011

Knuckle Failure Internal Pressure (Pck):

= 2.0 * Py
= 2.0 * 19.502
= 39.004 psig

Maximum Allowable Pressure (MAPNC):

= Pck / 1.5
= 39.004 / 1.5
= 26.003 psig

Final Internal Pressure Results:

Final Required Thickness (TR):

= MAX[UG16B, TR(App.1-4d) OR TR(UG32e), TR(App.1-4f)]
= MAX[0.0625 , 0.0788 , 0.1320]
= 0.1320 in.

Final Maximum Allowable Working Pressure (MAWP):

= MIN[MAWP(App.1-4d) OR MAWP(UG32e), MAWP(App.1-4f)]
= MIN[34.85 , 23.14]
= 23.1422 psig

Final Maximum Allowable Pressure, New and Cold (MAPNC):

= MIN[MAPNC(App.1-4d) OR MAPNC(UG32e), MAPNC(App.1-4f)]
= MIN[34.85 , 26.00]
= 26.0025 psig

SUMMARY OF INTERNAL PRESSURE RESULTS:

Required Thickness plus Corrosion Allowance, Trca	0.1320	in.
Actual Thickness as Given in Input	0.1830	in.
Maximum Allowable Working Pressure	MAWP	23.142 psig
Maximum Allowable Pressure, NC	MAPNC	26.003 psig
Design Pressure as Given in Input	P	15.000 psig

Hydrostatic Test Pressures (Measured at High Point):

Hydrotest per UG-99(b); 1.3 * MAWP * Sa/S	30.08	psig
Hydrotest per UG-99(c); 1.3 * MAPNC	33.80	psig
Pneumatic per UG-100 ; 1.1 * MAWP * Sa/S	25.46	psig

Percent Elongation per UHA-44 (75 * tnom/Rf * (1-Rf/Ro)) 1.808 %

Note: Please Check Requirements of Table UHA-44 for Elongation limits.

External Pressure Results, Shell Number 1, Desc.: Top Head

ASME Code, Section VIII, Division 1, 2010

External Pressure Chart	HA-1	at	150.00	F
Elastic Modulus for Material			27650000.00	psi

Results for Max. Allowable External Pressure (Emawp):

Corroded Thickness of Head	TCA	0.1830	in.
Outside Crown Radius	Ro	120.183	in.
Crown Rad / Thickness Ratio	(Ro/T)	656.7377	
Geometry Factor, A (.125/(Ro/T))	A	0.0001903	
Materials Factor, B, f(A, Chart)	B	2631.3777	psi

PV Elite 2011 Licensee: DESIGN ENGINEERING ANALYSIS CORP.

FileName : Tank T-1(10-03-11) -----

Shell Analysis : Top Head

Item: 1 3:55p Oct 3,2011

Maximum Allowable Working Pressure 4.01 psig
 EMAWP = $B/(Ro/T) = 2631.3777 / 656.7377 = 4.0067$

Results for Req'd Thickness for Ext. Pressure (Tca):

Corroded Thickness of Head	TCA	0.0646	in.
Outside Crown Radius	Ro	120.183	in.
Crown Rad / Thickness Ratio	(Ro/T)	1859.0458	
Geometry Factor, A (.125/(Ro/T))	A	0.0000672	
Materials Factor, B, f(A, Chart)	B	929.5764	psi
Maximum Allowable Working Pressure		0.50	psig
EMAWP = $B/(Ro/T) = 929.5764 / 1859.0458 = 0.5000$			

Summary of External Pressure Results:

Allowable Pressure at Corroded thickness	4.01	psig
Required Pressure as entered by User	0.50	psig
Required Thickness including Corrosion all.	0.0646	in.
Actual Thickness as entered by User	0.1830	in.

Weight and Volume Results, No C.A. :

Volume of Shell Component	VOLMET	2575.9	in.^3
Weight of Shell Component	WMET	721.3	lb.
Inside Volume of Component	VOLID	141912.5	in.^3
Weight of Water in Component	WWAT	5737.2	lb.
Inside Vol. of 1.50 in. Straight	VOLSCA	16964.6	in.^3
Total Volume for Head + Straight	VOLTOT	158877.1	in.^3

PV Elite is a trademark of Intergraph CADWorx & Analysis Solutions, Inc. 2011

PV Elite 2011 Licensee: DESIGN ENGINEERING ANALYSIS CORP.

FileName : Tank T-1(10-03-11)

Shell Analysis : Cylinder

Item: 2 3:55p Oct 3,2011

Input Echo, Component 2,

Description: Cylinder

Design Internal Pressure	P	15.00	psig
Temperature for Internal Pressure		150.00	F
Design External Pressure	PEXT	0.50	psig
Temperature for External Pressure		150.00	F
External Pressure Chart Name		HA-1	
Include Hydrostatic Head Components		YES	
Operating Liquid Density		93.600	lb./ft ³
Height of Liquid Column (Operating)		192.00	in.
Height of Liquid Column (Hydrotest)		192.00	in.
Material Specification		SA-240 304	
Material UNS Number		S30400	
Material Form used		Plate	
Allowable Stress At Temperature	S	20000.00	psi
Allowable Stress At Ambient	SA	20000.00	psi
Yield Stress At Temperature	Sy	26700.00	psi
Joint efficiency for Shell Joint	E	0.70	
Design Length of Section	L	192.000	in.
Length of Cylinder for Volume Calcs.	CYLLN	192.000	in.
Inside Diameter of Cylindrical Shell	D	120.000	in.
Minimum Thickness of Pipe or Plate	T	0.1760	in.
Shell/Head Int. Corrosion Allowance	CA	0.0000	in.
Skip UG-16(b) Min. thickness calculation		NO	
Type of Element:		Cylindrical Shell	

Internal pressure results, Shell Number 2, Desc.: Cylinder

ASME Code, Section VIII, Division 1, 2010

Thickness Due to Internal Pressure (Tr):

$$\begin{aligned}
 &= (P \cdot (D/2 + CA)) / (S \cdot E - 0.6 \cdot P) \text{ per UG-27 (c) (1)} \\
 &= (25.40 \cdot (120.0000/2 + 0.0000)) / (20000.00 \cdot 0.70 - 0.6 \cdot 25.40) \\
 &= 0.1090 + 0.0000 = 0.1090 \text{ in.}
 \end{aligned}$$

Max. All. Working Pressure at Given Thickness (MAWP):

Less Operating Hydrostatic Head Pressure of 10.40 psig

$$\begin{aligned}
 &= (S \cdot E \cdot (T - CA - CAE)) / ((D/2 + CA) + 0.6 \cdot (T - CA - CAE)) \text{ per UG-27 (c) (1)} \\
 &= (20000.00 \cdot 0.70 \cdot (0.1760)) / ((120.0000/2 + 0.0000) + 0.6 \cdot 0.1760) \\
 &= 40.99 - 10.40 = 30.59 \text{ psig}
 \end{aligned}$$

Maximum Allowable Pressure, New and Cold (MAPNC):

$$\begin{aligned}
 &= (SA \cdot E \cdot T) / (D/2 + 0.6 \cdot T) \text{ per UG-27 (c) (1)} \\
 &= (20000.00 \cdot 0.70 \cdot 0.1760) / (120.0000/2 + 0.6 \cdot 0.1760) \\
 &= 40.99 \text{ psig}
 \end{aligned}$$

Actual stress at given pressure and thickness (Sact):

$$\begin{aligned}
 &= (P \cdot ((D/2 + CA) + 0.6 \cdot (T - CA - CAE))) / (E \cdot (T - CA - CAE)) \\
 &= (25.40 \cdot ((120.0000/2 + 0.0000) + 0.6 \cdot (0.1760))) / (0.70 \cdot (0.1760)) \\
 &= 12391.90 \text{ psi}
 \end{aligned}$$

PV Elite 2011 Licensee: DESIGN ENGINEERING ANALYSIS CORP.

FileName : Tank T-1(10-03-11)

Shell Analysis : Cylinder

Item: 2 3:55p Oct 3,2011

SUMMARY OF INTERNAL PRESSURE RESULTS:

Required Thickness plus Corrosion Allowance, Trca	0.1090	in.
Actual Thickness as Given in Input	0.1760	in.
Maximum Allowable Working Pressure	MAWP	30.595 psig
Maximum Allowable Pressure, NC	MAPNC	40.995 psig
Design Pressure as Given in Input	P	15.000 psig

Hydrostatic Test Pressures (Measured at High Point):

Hydrotest per UG-99(b); 1.3 * MAWP * Sa/S	39.77	psig
Hydrotest per UG-99(c); 1.3 * MAPNC - Head (Hydro)	46.36	psig
Pneumatic per UG-100 ; 1.1 * MAWP * Sa/S	45.09	psig

Percent Elongation per UHA-44 (50 * tnom/Rf * (1-Rf/Ro)) 0.146 %

Note: Please Check Requirements of Table UHA-44 for Elongation limits.

External Pressure Results, Shell Number 2, Desc.: Cylinder**ASME Code, Section VIII, Division 1, 2010**

External Pressure Chart	HA-1	at	150.00	F
Elastic Modulus for Material			27650000.00	psi

Results for Max. Allowable External Pressure (Emawp):

Corroded Thickness of Shell	TCA	0.1760	in.
Outside Diameter of Shell	ODCA	120.352	in.
Design Length of Cylinder or Cone	SLEN	192.000	in.
Diameter / Thickness Ratio	(D/T)	683.8181	
Length / Diameter Ratio	LD	1.5953	
Geometry Factor, A f(DT,LD)	A	0.0000461	
Materials Factor, B, f(A, Chart)	B	636.8831	psi
Maximum Allowable Working Pressure		1.24	psig
EMAWP = (4*B)/(3*(D/T)) = (4 *636.8831)/(3 *683.8181) = 1.2418			

Results for Req'd Thickness for Ext. Pressure (Tca):

Corroded Thickness of Shell	TCA	0.1224	in.
Outside Diameter of Shell	ODCA	120.352	in.
Design Length of Cylinder or Cone	SLEN	192.000	in.
Diameter / Thickness Ratio	(D/T)	983.2286	
Length / Diameter Ratio	LD	1.5953	
Geometry Factor, A f(DT,LD)	A	0.0000267	
Materials Factor, B, f(A, Chart)	B	368.7256	psi
Maximum Allowable Working Pressure		0.50	psig
EMAWP = (4*B)/(3*(D/T)) = (4 *368.7256)/(3 *983.2286) = 0.5000			

Results for Maximum Length Between Stiffeners (Slen):

Corroded Thickness of Shell	TCA	0.1760	in.
Outside Diameter of Shell	ODCA	120.352	in.
Design Length of Cylinder or Cone	SLEN	473.745	in.
Diameter / Thickness Ratio	(D/T)	683.8181	
Length / Diameter Ratio	LD	3.9363	
Geometry Factor, A f(DT,LD)	A	0.0000185	
Materials Factor, B, f(A, Chart)	B	256.4535	psi
Maximum Allowable Working Pressure		0.50	psig
EMAWP = (4*B)/(3*(D/T)) = (4 *256.4535)/(3 *683.8181) = 0.5000			

Summary of External Pressure Results:

Allowable Pressure at Corroded thickness	1.24	psig
Required Pressure as entered by User	0.50	psig
Required Thickness including Corrosion all.	0.1224	in.
Actual Thickness as entered by User	0.1760	in.
Maximum Length for Thickness and Pressure	473.745	in.
Actual Length as entered by User	192.00	in.

Weight and Volume Results, No C.A. :

Volume of Shell Component	VOLMET	12757.8	in.^3
Weight of Shell Component	WMET	3572.2	lb.
Inside Volume of Component	VOLID	2171469.0	in.^3
Weight of Water in Component	WWAT	78414.2	lb.

FileName : Tank T-1(10-03-11)

Conical Analysis : Lower Cone

Item: 1 3:55p Oct 3,2011

Input Echo, Cone Item 1,

Description: Lower Cone

Design Internal Pressure	PINT	15.00	psig
Temperature for Internal Pressure	TEMPIN	150.00	F
Design External Pressure	PEXT	0.50	psig
Temperature for External Pressure	TEMPEX	150.00	F
Take Cone as Line of Support for External Pressure:		No	
Cone Material		SA-240 304	
Cone Material UNS Number		S30400	
Cone Allowable Stress at Temperature	SAC	20000.00	psi
Cone Allowable Stress At Ambient	SOC	20000.00	psi
Longitudinal Joint Efficiency of Cone	EC	0.7000	
Circumferential Joint Efficiency of Cone	ECC	0.8500	
Actual Thickness of Cone	TC	0.1670	in.
Corrosion Allowance for Cone	CAC	0.0000	in.
Diameter Basis for Cone and Cylinders	BASIS	ID	
Diameter of Small End of Cone	DS	16.000	in.
Diameter of Large End of Cone	DL	120.000	in.
Half Apex Angle for Cone	ANGLE	28.44	degrees
Axial Length of Cone	LC	96.000	in.
Small End Cylinder Material		SA-105	
Small End Cylinder Material UNS Number		K03504	
Small Cylinder Allowable Stress at Operating	SAS	20000.00	psi
Small Cylinder Allowable Stress At Ambient	SOS	20000.00	psi
Joint Efficiency of Small Cylinder	ES	0.7000	
Actual Thickness of Small Cylinder	TS	0.3750	in.
Corrosion Allowance for Small Cylinder	CAS	0.0000	in.
Axial Length of Small Cylinder	LS	4.000	in.
Large End Cylinder Material		SA-240 304	
Large End Cylinder Material UNS Number		S30400	
Large Cylinder Allowable Stress at Operating	SAL	20000.00	psi
Large Cylinder Allowable Stress At Ambient	SOL	20000.00	psi
Joint Efficiency of Large Cylinder	EL	0.7000	
Actual Thickness of Large Cylinder	TL	0.1760	in.
Corrosion Allowance for Large Cylinder	CAL	0.0000	in.
Axial Length of Large Cylinder	LL	6.000	in.
Type of Reinforcement at Large End of Cone:		None	
Large End Reinforcing/Knuckle Material		SA-240 304	
Large End Reinforcing/Knuckle Material UNS Num		S30400	
Large Reinforcing/Knuckle Allowable, Operating		20000.00	psi
Large Reinforcing/Knuckle Allowable, Ambient		20000.00	psi
Type of Reinforcement at Small End of Cone:		None	
Small End Reinforcing/Knuckle Material		SA-240 304	
Small End Reinforcing/Knuckle Material UNS Num		S30400	
Small Reinforcing/Knuckle Allowable, Operating		20000.00	psi
Small Reinforcing/Knuckle Allowable, Ambient		20000.00	psi

PV Elite 2011 Licensee: DESIGN ENGINEERING ANALYSIS CORP.

FileName : Tank T-1(10-03-11)

Conical Analysis : Lower Cone

Item: 1 3:55p Oct 3,2011

Internal Pressure Results, Cone Number 1, Description: Lower Cone
ASME Code, Section VIII, Division 1, 2010

INTERNAL PRESSURE CALCULATIONS for CONE:

Thickness Due to Internal Pressure (Tr):

$$= (P*(D+2*CA/\cos(\alpha))) / (2*\cos(\alpha)*(S*E-0.6*P)) \text{ per App. 1-4(e)}$$

$$= (15.00*(120.0000+2*0.0000))/(2*0.8793*(20000.00*0.70-0.6*15.00))$$

$$= 0.0732 + 0.0000 = 0.0732 \text{ in.}$$

Max. All. Working Pressure at Given Thickness (MAWP):

$$= (2*S*E*(T-CA-CAE)*\cos(\alpha)) / ((D+2*CA/\cos(\alpha))+1.2*(T-CA-CAEXT)*\cos(\alpha)) \text{ per App 1-4(e)}$$

$$= (2*20000.00*0.70*(0.1670)*0.8793) / ((120.0000+2*0.0000)+1.2*(0.1670)*0.8793)$$

$$= 34.21 \text{ psig}$$

INTERNAL PRESSURE CALCULATIONS for SMALL CYLINDER:

Thickness Due to Internal Pressure (Tr):

$$= (P*(D/2+CA)) / (S*E-0.6*P) \text{ per UG-27 (c) (1)}$$

$$= (15.00*(16.0000/2+0.0000))/(20000.00*0.70-0.6*15.00)$$

$$= 0.0086 + 0.0000 = 0.0086 \text{ in.}$$

Max. All. Working Pressure at Given Thickness (MAWP):

$$= (S*E*(T-CA-CAE)) / ((D/2+CA)+0.6*(T-CA-CAE)) \text{ per UG-27 (c) (1)}$$

$$= (20000.00*0.70*(0.3750)) / ((16.0000/2+0.0000)+0.6*0.3750)$$

$$= 638.30 \text{ psig}$$

INTERNAL PRESSURE CALCULATIONS for LARGE CYLINDER:

Thickness Due to Internal Pressure (Tr):

$$= (P*(D/2+CA)) / (S*E-0.6*P) \text{ per UG-27 (c) (1)}$$

$$= (15.00*(120.0000/2+0.0000))/(20000.00*0.70-0.6*15.00)$$

$$= 0.0643 + 0.0000 = 0.0643 \text{ in.}$$

Max. All. Working Pressure at Given Thickness (MAWP):

$$= (S*E*(T-CA-CAE)) / ((D/2+CA)+0.6*(T-CA-CAE)) \text{ per UG-27 (c) (1)}$$

$$= (20000.00*0.70*(0.1760)) / ((120.0000/2+0.0000)+0.6*0.1760)$$

$$= 40.99 \text{ psig}$$

SUMMARY of INT. PRESSURE RESULTS:

	Small Cyl	Cone	Large Cyl
Required Thickness plus CA	0.0086	0.0732	0.0643 in.
Actual Given Thickness	0.3750	0.1670	0.1760 in.
Max. All. Working Pressure	638.30	34.21	40.99 psig
Design Pressure as Given	15.00	15.00	15.00 psig

External Pressure Results, Cone Number 1, Description: Lower Cone
ASME Code, Section VIII, Division 1, 2010

EXTERNAL PRESSURE CALCULATIONS for COMBINED CONE and CYLINDERS

Based on Diameter and Thickness of CONE:

External Pressure Chart HA-1 at 150.00 F
Elastic Modulus for Material 27650000.00 psi

PV Elite 2011 Licensee: DESIGN ENGINEERING ANALYSIS CORP.

FileName : Tank T-1(10-03-11)

Conical Analysis : Lower Cone

Item: 1 3:55p Oct 3,2011

Results for Maximum Allowable External Pressure:

Corroded Thickness of Shell	TCA	0.1670	in.
Outside Diameter of Shell	OD	120.334	in.
Design Length of Cylinder or Cone	SLEN	106.00	in.
Diameter / Thickness Ratio	DT	720.5629	
Length / Diameter Ratio	LD	0.8809	
Geometry Factor, A f(DT,LD)	A	0.0000778	
Materials Factor, B, f(A, Chart)	B	1075.2955	psi
Maximum Allowable Working Pressure		1.99	psig
$EMAWP = (4*B)/(3*DT) = (4 * 1075.296) / (3 * 720.5629) = 1.9897$			

Results for Required Thickness for External Pressure:

Corroded Thickness of Shell	TCA	0.0963	in.
Outside Diameter of Shell	OD	120.334	in.
Design Length of Cylinder or Cone	SLEN	106.00	in.
Diameter / Thickness Ratio	DT	1249.6322	
Length / Diameter Ratio	LD	0.8809	
Geometry Factor, A f(DT,LD)	A	0.0000339	
Materials Factor, B, f(A, Chart)	B	468.6402	psi
Maximum Allowable Working Pressure		0.50	psig
$EMAWP = (4*B)/(3*DT) = (4 * 468.640) / (3 * 1249.6322) = 0.5000$			

Based on Diameter and Thickness at LARGE End:

External Pressure Chart	HA-1	at	150.00	F
Elastic Modulus for Material			27650000.00	psi

Results for Maximum Allowable External Pressure:

Corroded Thickness of Shell	TCA	0.1760	in.
Outside Diameter of Shell	OD	120.352	in.
Design Length of Cylinder or Cone	SLEN	106.00	in.
Diameter / Thickness Ratio	DT	683.8181	
Length / Diameter Ratio	LD	0.8807	
Geometry Factor, A f(DT,LD)	A	0.0000842	
Materials Factor, B, f(A, Chart)	B	1163.8967	psi
Maximum Allowable Working Pressure		2.27	psig
$EMAWP = (4*B)/(3*DT) = (4 * 1163.897) / (3 * 683.8181) = 2.2694$			

Results for Required Thickness for External Pressure:

Corroded Thickness of Shell	TCA	0.0963	in.
Outside Diameter of Shell	OD	120.352	in.
Design Length of Cylinder or Cone	SLEN	106.00	in.
Diameter / Thickness Ratio	DT	1249.7045	
Length / Diameter Ratio	LD	0.8807	
Geometry Factor, A f(DT,LD)	A	0.0000339	
Materials Factor, B, f(A, Chart)	B	468.6704	psi
Maximum Allowable Working Pressure		0.50	psig
$EMAWP = (4*B)/(3*DT) = (4 * 468.670) / (3 * 1249.7045) = 0.5000$			

Based on Diameter and Thickness at SMALL End:

External Pressure Chart	CS-2	at	150.00	F
Elastic Modulus for Material			29000000.00	psi

Results for Maximum Allowable External Pressure:

Corroded Thickness of Shell	TCA	0.3750	in.
-----------------------------	-----	--------	-----

FileName : Tank T-1(10-03-11)

Conical Analysis : Lower Cone

Item: 1 3:55p Oct 3,2011

Outside Diameter of Shell	OD	16.750	in.
Design Length of Cylinder or Cone	SLEN	106.00	in.
Diameter / Thickness Ratio	DT	44.6667	
Length / Diameter Ratio	LD	6.3284	
Geometry Factor, A f(DT,LD)	A	0.0006955	
Materials Factor, B, f(A, Chart)	B	10085.3379	psi
Maximum Allowable Working Pressure		301.05	psig
EMAWP = (4*B)/(3*DT) = (4 *10085.338)/(3 *44.6667) = 301.0548			

Results for Required Thickness for External Pressure:

Corroded Thickness of Shell	TCA	0.0291	in.
Outside Diameter of Shell	OD	16.750	in.
Design Length of Cylinder or Cone	SLEN	106.00	in.
Diameter / Thickness Ratio	DT	576.1018	
Length / Diameter Ratio	LD	6.3284	
Geometry Factor, A f(DT,LD)	A	0.0000149	
Materials Factor, B, f(A, Chart)	B	216.0528	psi
Maximum Allowable Working Pressure		0.50	psig
EMAWP = (4*B)/(3*DT) = (4 *216.053)/(3 *576.1018) = 0.5000			

SUMMARY of EXT. PRESSURE RESULTS:

	Small Cyl	Cone	Large Cyl	
Reqd. Thickness + CA	0.0291	0.0963	0.0963	in.
Actual Given Thickness	0.3750	0.1670	0.1760	in.
Max. All. Working Pressure	301.05	1.99	2.27	psig
Design Pressure as Given	0.50	0.50	0.50	psig

Computing the Modulus of Elasticity per ASME table TM-1 :

Properties at Design External temperature (150.00 F) :

Elastic Modulus for Cone Material	27807692.00	psi
Elastic Modulus for Small Cylinder Material	29030770.00	psi
Elastic Modulus for Large Cylinder Material	27807692.00	psi
Elastic Modulus for Large End Reinforcement	27807692.00	psi
Elastic Modulus for Small End Reinforcement	27807692.00	psi

Properties at Design Internal temperature (150.00 F) :

Elastic Modulus for Cone Material	27807692.00	psi
Elastic Modulus for Small Cylinder Material	29030770.00	psi
Elastic Modulus for Large Cylinder Material	27807692.00	psi
Elastic Modulus for Large End Reinforcement	27807692.00	psi
Elastic Modulus for Small End Reinforcement	27807692.00	psi

REINFORCEMENT CALCULATIONS for CONE / LARGE CYLINDER:

REQUIRED AREA of REINFORCEMENT for LARGE END UNDER INTERNAL PRESSURE

Large end ratio of pressure to allowable stress	0.00107	
Large end max. half apex angle w/o reinforcement	11.286	degrees
Large end actual half apex angle	28.440	degrees

Required Area of Reinforcement, Large End, Internal [Arl]:

$$= (RKL * QL * RCLI / (SAL * EL)) * (1 - DELTA / ANGLE) * TANA$$

$$= (1.00 * 450.000 * 60.0000 / (20000 * 0.70)) *$$

$$(1.0 - 11.29 / 28.44) * 0.5416$$

FileName : Tank T-1(10-03-11)

Conical Analysis : Lower Cone

Item: 1 3:55p Oct 3,2011

$$= 0.6300 \text{ in}^2$$

Area of Reinforcement Available in Large End Shell [Ael]:

$$= (\text{TLC} - \text{TREQ}) * \text{SQRT}(\text{RCLO} * \text{TLC}) +$$

$$(\text{TCC} - \text{TREQ}) * \text{SQRT}(\text{RCLO} * \text{TCC} / \text{COSA})$$

$$= (0.1760 - 0.0643) * \text{SQRT}(60.0000 * 0.1760) +$$

$$(0.1670 - 0.0732) * \text{SQRT}(60.0000 * 0.1670 / 0.8793)$$

$$= 0.6797 \text{ in}^2$$

SUMMARY of REINFORCEMENT AREA, LARGE END, INTERNAL PRESSURE:

Area of reinforcement required per App. 1-5(1)	0.6300	in ²
Area of reinforcement in shell per App. 1-5(2)	0.6797	in ²
Area of reinforcement in stiffening ring	0.0000	in ²
Additional Area needed to satisfy requirements	0.0000	in ²

REQUIRED AREA of REINFORCEMENT for LARGE END UNDER EXTERNAL PRESSURE

Large end ratio of pressure to allowable stress	0.00004	
Large end max. half apex angle w/o reinforcement	0.089	degrees
Large end actual half apex angle	28.440	degrees

Area of Reinforcement Required in Large End Shell [Arl]:

$$= (\text{RKLE} * \text{QL} * \text{RCLO} * \text{TAN}(\text{Alpha})) / (\text{SOL} * \text{EL}) *$$

$$(1.0 - 0.25 * ((\text{PEXT} * \text{RCLO} - \text{QL}) / \text{QL}) * (\text{Delta} / \text{Angle}))$$

$$= (1.0000 * 15.0440 * 60.1760 * 0.542 / (20000 * 0.70)) *$$

$$(1.0 - 0.25 * ((0.50 * 60.1760 - 15.0440) / 15.0440)) *$$

$$(0.0893 / 28.4400)$$

$$= 0.0350 \text{ in}^2$$

Area of Reinforcement Available in Large End Shell [Ael]:

$$= .55 * (\text{Dl} * \text{ts})^{1/2} * (\text{ts} + \text{tc} / \text{Cos}(\text{Alpha}))$$

$$= .55 * (120.352 * 0.176)^{1/2} * (0.176 + 0.167 / 0.879)$$

$$= 0.9263 \text{ in}^2$$

SUMMARY of REINFORCEMENT AREA, LARGE END, EXTERNAL PRESSURE:

Area of reinforcement required per App. 1-8(1)	0.0350	in ²
Area of reinforcement in shell per App. 1-8(2)	0.9263	in ²
Area of reinforcement in stiffening ring	0.0000	in ²
Additional Area needed to satisfy requirements	0.0000	in ²

REINFORCEMENT CALCULATIONS for CONE / SMALL CYLINDER:

REQUIRED AREA of REINFORCEMENT for SMALL END under INTERNAL PRESSURE

Small end ratio of pressure to allowable stress	0.00107	
Small end max. half apex angle w/o reinforcement	4.000	degrees
Small end actual half apex angle	28.440	degrees

Required Area of Reinforcement, Small End, Internal [Ars]:

$$= (\text{RKS} * \text{QS} * \text{RCSI} / (\text{SAS} * \text{ES})) * (1 - \text{DELTA} / \text{ANGLE}) * \text{TanAlpha}$$

$$= (1.00 * 60.000 * 8.0000 / (20000 * 0.70)) *$$

$$(1.0 - 4.00 / 28.44) * 0.5416$$

$$= 0.0160 \text{ in}^2$$

Area of Reinforcement Available in Small End Shell [Aes]:

$$= .78 * (\text{Rs} * \text{Ts})^{1/2} * ((\text{Ts} - \text{t}) + (\text{Tc} - \text{Tr}) / \text{Cos}(\text{alpha}))$$

$$= .78 * (8.000 * 0.375)^{1/2} * ((0.375 - 0.009) + (0.167 - 0.010) / 0.88)$$

$$= 0.7366 \text{ in}^2$$

PV Elite 2011 Licensee: DESIGN ENGINEERING ANALYSIS CORP.

FileName : Tank T-1(10-03-11) -----

Conical Analysis : Lower Cone Item: 1 3:55p Oct 3,2011

SUMMARY of REINFORCEMENT AREA, SMALL END, INTERNAL PRESSURE:

Area of reinforcement required per App. 1-5(3)	0.0160	in ²
Area of reinforcement in shell per App. 1-5(4)	0.7366	in ²
Area of reinforcement in stiffening ring	0.0000	in ²
Additional Area needed to satisfy requirements	0.0000	in ²

REQUIRED AREA of REINFORCEMENT for SMALL END under EXTERNAL PRESSURE

Area of Reinforcement Required in Small End Shell [Ars]:

= (RKSE * QS * RCSI * Tan(Alpha) / (SOS*ES))
 = (1.0440*2.0938*8.3750*0.5416/(20000*0.70))
 = 0.0007 in²

Area of Reinforcement Available in Small End Shell [Aes]:

= .55*(Ds*ts)^{3/2} *[(ts-t)+(tc-tr)/Cos(angle)]]
 = .55*(16.750 *0.375)^{3/2} *[(0.375 -0.029)+(0.167 -0.025)/0.879]]
 = 0.6987 in²

SUMMARY of REINFORCEMENT AREA, SMALL END, EXTERNAL PRESSURE:

Area of reinforcement required per App. 1-8(1)	0.0007	in ²
Area of reinforcement in shell per App. 1-8(2)	0.6987	in ²
Area of reinforcement in stiffening ring	0.0000	in ²
Additional Area needed to satisfy requirements	0.0000	in ²

Results for Discontinuity Stresses per Bednar p. 236 2nd Edition

Stress Type	Stress	Allowable	Location
Tensile Stress	432.88	60000.00	Small Cyl. Long.
Compres. Stress	-105.38	-60000.00	Small Cyl. Long.
Membrane Stress	843.96	30000.00	Small End Tang.
Tensile Stress	1775.18	60000.00	Cone Longitudinal
Compres. Stress	-938.85	-60000.00	Cone Longitudinal
Tensile Stress	1352.80	30000.00	Cone Tangential
Tensile Stress	31078.10	60000.00	Large Cyl. Long.
Compres. Stress	-25956.96	-60000.00	Large Cyl. Long.
Membrane Stress	-11484.08	-30000.00	Large End Tang.
Tensile Stress	34743.04	60000.00	Cone Longitudinal
Compres. Stress	-28605.18	-60000.00	Cone Longitudinal
Compres. Stress	-10467.35	-30000.00	Cone Tangential

PV Elite 2011 Licensee: DESIGN ENGINEERING ANALYSIS CORP.

FileName : Tank T-1(10-03-11) -----

Conical Analysis : Lower Cone Item: 1 3:55p Oct 3,2011

Equivalent Pressures used in Discontinuity Stress Calc:

Small end Total Equivalent Pressure :

$$= P + P_{\text{force}_S} = 15.000 + 0.000 = 15.000 \text{ psig}$$

Large end Total Equivalent Pressure :

$$= P + P_{\text{force}_L} = 15.000 + 0.000 = 15.000 \text{ psig}$$

PV Elite is a trademark of Intergraph CADWorx & Analysis Solutions, Inc. 2011

FileName : Tank T-1(10-03-11)

Vessel Results Summary

Item: 1 3:55p Oct 3,2011

Summary for shell/head, Div 1:

Description	MAPNC psig	MAWP psig	Min. T in.	Tr-int in.	Tr-ext in.	EMAWP psig
Top Head	26.003	23.142	0.183	0.132	0.065	4.007
Cylinder	40.995	30.595	0.176	0.109	0.122	1.242
Minimum MAWP	26.003	23.142				1.242

Note: Req'd. thk. reported above includes Corrosion Allowance.

Total Shell/Head weight is (New-Cold) 4293.4 lb.
 Total Shell/Head weight is (Corroded) 4293.4 lb.
 Total Shell/Head weight, filled with Water (New) 88444.8 lb.
 Total Shell/Head volume is (New-Cold) 2330346.0 in.**3
 Total Shell/Head volume is (Corroded) 2330346.0 in.**3

Conical Results Summary for Item 1 : Lower Cone**SUMMARY of INT. PRESSURE RESULTS:**

	Small Cyl	Cone	Large Cyl
Required Thickness plus CA	0.0086	0.0732	0.0643 in.
Actual Given Thickness	0.3750	0.1670	0.1760 in.
Max. All. Working Pressure	638.30	34.21	40.99 psig
Design Pressure as Given	15.00	15.00	15.00 psig

SUMMARY of EXT. PRESSURE RESULTS:

	Small Cyl	Cone	Large Cyl
Req'd. Thickness + CA	0.0291	0.0963	0.0963 in.
Actual Given Thickness	0.3750	0.1670	0.1760 in.
Max. All. Working Pressure	301.05	1.99	2.27 psig
Design Pressure as Given	0.50	0.50	0.50 psig

Diameter [Small End] [Large End] 16.00 120.00 in.

Small End Weight [New/Cold], [Corr] 21.84 21.84 lb.
 Large End Weight [New/Cold], [Corr] 112.83 112.83 lb.
 Cone Weight [New/Cold], [Corr] 1105.34 1105.34 lb.

Small End Int. Volume [New/Cold], [Corr] 804.25 804.25 in.³
 Large End Int. Volume [New/Cold], [Corr] 67858.41 67858.41 in.³
 Cone Int. Volume [New/Cold], [Corr] 416600.34 416600.34 in.³

Least MAWP and Overall Weight Results :

The Least MAWP (N C) for Top Head was 26.00 psig .

The Least MAWP (Cor) for Top Head was 23.14 psig .

PV Elite 2011 Licensee: DESIGN ENGINEERING ANALYSIS CORP.

50

FileName : Tank T-1(10-03-11)

Vessel Results Summary

Item: 1 3:55p Oct 3,2011

The total sum of the Weights (N C) was 5533.43 lb. .

The total sum of the Weights (Cor) was 5533.43 lb. .

PV Elite is a trademark of Intergraph CADWorx & Analysis Solutions, Inc. 2011

PV Elite 2011 Licensee: DESIGN ENGINEERING ANALYSIS CORP.

FileName : Tank T-1-2-5-6 ----- Page 1 of 10

Natural Frequency Calculation : Step: 6 9:07a Aug 24, 2011

The Natural Frequencies for the vessel have been computed iteratively by solving a system of matrices. These matrices describe the mass and the stiffness of the vessel. This is the generalized eigenvalue/eigenvector problem and is referenced in some mathematical texts.

The Natural Frequency for the Vessel (Empty.) is 51.7511 Hz.

The Natural Frequency for the Vessel (Ope...) is 12.6409 Hz.

The Natural Frequency for the Vessel (Filled) is 12.8081 Hz.

PV Elite is a trademark of Intergraph CADWorx & Analysis Solutions, Inc. 2011

Note: Using the User Defined Wind Profile ...

Wind Vibration Calculations

This evaluation is based on work by Kanti Mahajan and Ed Zorilla

Nomenclature

Cf - Correction factor for natural frequency
 D - Average internal diameter of vessel ft.
 Df - Damping Factor < 0.75 Unstable, > 0.95 Stable
 Dr - Average internal diameter of top half of vessel ft.
 f - Natural frequency of vibration (Hertz)
 f1 - Natural frequency of bare vessel based on a unit value of $(D/L^2)(10^4)$
 L - Total height of structure ft.
 Lc - Total length of conical section(s) of vessel ft.
 tb - Uncorroded plate thickness at bottom of vessel in.
 V30 - Design Wind Speed provided by user mile/hr
 Vc - Critical wind velocity mile/hr
 Vw - Maximum wind speed at top of structure mile/hr
 W - Total corroded weight of structure lb.
 Ws - Cor. vessel weight excl. weight of parts which do not effect stiff. lb.
 Z - Maximum amplitude of vibration at top of vessel in.
 DL - Logarithmic decrement (taken as 0.03 for Welded Structures)
 Vp - Vib. Chance, $\leq 0.200E+02$ (High); $0.200E+02 < 0.250E+02$ (Probable)
 P30 - wind pressure 30 feet above the base

Check other Conditions and Basic Assumptions:

#1 - Total Cone Length / Total Length < 0.5
 $8.000 / 19.100 = 0.419$

#2 - $(D / L^2) * 10^4 < 8.0$ (English Units)
 $-(10.01 / 19.10^2) * 10^4 = 274.341$ [Geometry Violation]

Compute the vibration possibility. If $V_p > 0.250E+02$ no chance. [Vp]:

$$= W / (L * Dr^2)$$

$$= 133216 / (19.10 * 10.000^2)$$

$$= 0.69747E+02$$

Since V_p is $> 0.250E+02$ no further vibration analysis is required !

The Natural Frequency for the Vessel (Ope...) is 12.6409 Hz.

Wind Load Calculation

From	To	Wind Height ft.	Wind Diameter ft.	Wind Area sq.in.	Height Factor psf	Element Wind Load lb.
10	20	1.50000	10.0395	4337.06	16.0000	481.896
20	30	3.05000	5.69450	82.0008	16.0000	9.11120
30	40	3.35000	10.0293	722.112	16.0000	80.2347
40	50	4.35000	10.0293	2166.34	16.0000	240.704
50	60	7.97500	10.0293	8304.29	16.0000	922.699
60	70	11.9750	10.0293	3249.50	16.0000	361.056
70	80	14.1000	10.0293	2888.45	16.0000	320.939
80	90	16.1000	10.0293	2888.45	16.0000	320.939

PV Elite 2011 Licensee: DESIGN ENGINEERING ANALYSIS CORP.

FileName : Tank T-1-2-5-6

Page 3 of 10

Wind Load Calculation :

Step:

7

9:07a Aug 24, 2011

90	100	17.3900	10.0293	837.650	16.0000	93.0722
100	110	18.2650	10.0293	1689.74	16.0000	187.749
110	120	19.6905	10.0305	2296.24	16.0000	255.138

The Natural Frequency for the Vessel (Empty.) is 51.7511 Hz.

Wind Load Calculation

From	To	Wind Height ft.	Wind Diameter ft.	Wind Area sq.in.	Height Factor psf	Element Wind Load lb.
10	20	1.50000	10.0395	4337.06	16.0000	481.896
20	30	3.05000	5.69450	82.0008	16.0000	9.11120
30	40	3.35000	10.0293	722.112	16.0000	80.2347
40	50	4.35000	10.0293	2166.34	16.0000	240.704
50	60	7.97500	10.0293	8304.29	16.0000	922.699
60	70	11.9750	10.0293	3249.50	16.0000	361.056
70	80	14.1000	10.0293	2888.45	16.0000	320.939
80	90	16.1000	10.0293	2888.45	16.0000	320.939
90	100	17.3900	10.0293	837.650	16.0000	93.0722
100	110	18.2650	10.0293	1689.74	16.0000	187.749
110	120	19.6905	10.0305	2296.24	16.0000	255.138

The Natural Frequency for the Vessel (Filled) is 12.8081 Hz.

Wind Load Calculation

From	To	Wind Height ft.	Wind Diameter ft.	Wind Area sq.in.	Height Factor psf	Element Wind Load lb.
10	20	1.50000	10.0395	4337.06	16.0000	481.896
20	30	3.05000	5.69450	82.0008	16.0000	9.11120
30	40	3.35000	10.0293	722.112	16.0000	80.2347
40	50	4.35000	10.0293	2166.34	16.0000	240.704
50	60	7.97500	10.0293	8304.29	16.0000	922.699
60	70	11.9750	10.0293	3249.50	16.0000	361.056
70	80	14.1000	10.0293	2888.45	16.0000	320.939
80	90	16.1000	10.0293	2888.45	16.0000	320.939
90	100	17.3900	10.0293	837.650	16.0000	93.0722
100	110	18.2650	10.0293	1689.74	16.0000	187.749
110	120	19.6905	10.0305	2296.24	16.0000	255.138

PV Elite is a trademark of Intergraph CADWorx & Analysis Solutions, Inc. 2011

PV Elite 2011 Licensee: DESIGN ENGINEERING ANALYSIS CORP.

FileName : Tank T-1-2-5-6 ----- Page 4 of 10

Earthquake Load Calculation : Step: 8 9:07a Aug 24, 2011

Earthquake Loading Specified in G's

Horizontal Acceleration factor	(GX)	0.185
Horizontal Acceleration factor	(GZ)	0.000
Vertical Acceleration factor	(GY)	0.049

Note: +Y Direction G loads should also be run in the negative direction.
to insure maximum support loads are calculated.

The Natural Frequency for the Vessel (Ope...) is 12.6409 Hz.

Earthquake Load Calculation

From	To	Earthquake Height ft.	Earthquake Weight lb.	Element Ope Load lb.	Element Emp Load lb.
10	20	1.50000	1262.61	233.582	233.582
20	30	3.05000	23698.6	4384.24	209.554
30	40	3.35000	115.617	21.3892	21.3892
40	50	4.35000	11373.8	2104.16	64.1688
50	60	7.97500	43699.8	8084.46	264.486
60	70	11.9750	17192.8	3180.67	120.678
70	80	14.1000	15265.2	2824.06	104.065
80	90	16.1000	15165.1	2805.55	85.5567
90	100	17.3900	4397.89	813.609	24.8114
100	110	18.2650	270.547	50.0513	50.0513
110	120	18.9750	774.160	143.220	143.220

PV Elite is a trademark of Intergraph CADWorx & Analysis Solutions, Inc. 2011

The following table is for the Filled Case.

Cumulative Wind Shear and Bending Moment

From	To	Distance to Support ft.	Cummulative Wind Shear lb.	Wind Bending ft.lb.
10	20	1.50000	3273.54	33512.6
20	30	3.05000	2791.64	24414.8
30	40	3.35000	2782.53	24136.1
40	50	4.35000	2702.30	22764.9
50	60	7.97500	2461.59	18892.0
60	70	11.9750	1538.89	7390.56
70	80	14.1000	1177.84	4334.24
80	90	16.1000	856.898	2299.50
90	100	17.3900	535.959	906.647
100	110	18.2650	442.887	622.782
110	120	18.9750	255.138	214.437

The following table is for the Empty Case.

Wind/Earthquake Shear, Bending

From	To	Distance to Support ft.	Cummulative Wind Shear lb.	Earthquake Shear lb.	Wind Bending ft.lb.	Earthquake Bending ft.lb.
10	20	1.50000	3273.54	1321.56	33512.6	11905.2
20	30	3.05000	2791.64	1087.98	24414.8	8290.88
30	40	3.35000	2782.53	878.426	24136.1	8192.56
40	50	4.35000	2702.30	857.037	22764.9	7758.69
50	60	7.97500	2461.59	792.868	18892.0	6521.27
60	70	11.9750	1538.89	528.382	7390.56	2722.67
70	80	14.1000	1177.84	407.704	4334.24	1669.58
80	90	16.1000	856.898	303.639	2299.50	958.233
90	100	17.3900	535.959	218.082	906.647	436.512
100	110	18.2650	442.887	193.271	622.782	317.219
110	120	18.9750	255.138	143.220	214.437	120.372

The following table is for the Operating Case.

Wind/Earthquake Shear, Bending

From	To	Distance to Support ft.	Cummulative Wind Shear lb.	Earthquake Shear lb.	Wind Bending ft.lb.	Earthquake Bending ft.lb.
10	20	1.50000	3273.54	24645.0	33512.6	228381.
20	30	3.05000	2791.64	24411.4	24414.8	154796.
30	40	3.35000	2782.53	20027.2	24136.1	152574.
40	50	4.35000	2702.30	20005.8	22764.9	142566.
50	60	7.97500	2461.59	17901.6	18892.0	114135.
60	70	11.9750	1538.89	9817.15	7390.56	34443.8
70	80	14.1000	1177.84	6636.48	4334.24	15933.5
80	90	16.1000	856.898	3812.43	2299.50	5484.57
90	100	17.3900	535.959	1006.88	906.647	665.262
100	110	18.2650	442.887	193.271	622.782	317.219

PV Elite 2011 Licensee: DESIGN ENGINEERING ANALYSIS CORP.

FileName : Tank T-1-2-5-6 ----- Page 6 of 10

Wind/Earthquake Shear, Bending : Step: 9 9:07a Aug 24, 2011

110| 120| 18.9750 | 255.138 | 143.220 | 214.437 | 120.372 |

PV Elite is a trademark of Intergraph CADWorx & Analysis Solutions, Inc. 2011

Wind Deflection Calculations:

The following table is for the Filled(test) Case.

Note: Test Case Deflections were computed using un-corr. section properties.

Wind Deflection

From	To	Cumulative Wind Shear lb.	Centroid Deflection in.	Elem. End Deflection in.	Elem. Ang. Rotation
10	20	1080.27	...	0.00002	...
20	30	921.242	0.00002	0.00002	...
30	40	918.235	0.00002	0.00002	...
40	50	891.758	0.00004	0.00005	...
50	60	812.325	0.00011327	0.00019580	...
60	70	507.835	0.00023127	0.00026798	...
70	80	388.686	0.00030141	0.00033538	...
80	90	282.776	0.00036974	0.00040437	...
90	100	176.867	0.00041444	0.00042452	...
100	110	146.153	0.00044489	0.00046528	...
110	120	84.1956	0.00046964	0.00047400	...

Allowable deflection at the Tower Top (Hyd)(6.000"/100ft. Criteria)

Allowable deflection : 1.146 Actual Deflection : 0.000 in.

The following table is for the Empty Case.

Wind Deflection

From	To	Cumulative Wind Shear lb.	Centroid Deflection in.	Elem. End Deflection in.	Elem. Ang. Rotation
10	20	3273.54	0.00001	0.00005	...
20	30	2791.64	0.00005	0.00006	...
30	40	2782.53	0.00006	0.00007	...
40	50	2702.30	0.00010719	0.00014651	...
50	60	2461.59	0.00034326	0.00059332	0.00001
60	70	1538.89	0.00070082	0.00081207	0.00001
70	80	1177.84	0.00091335	0.0010163	0.00001
80	90	856.898	0.0011204	0.0012253	0.00001
90	100	535.959	0.0012559	0.0012864	0.00001
100	110	442.887	0.0013482	0.0014099	0.00001
110	120	255.138	0.0014232	0.0014364	0.00001

Allowable deflection at the Tower Top (Emp)(6.000"/100ft. Criteria)

Allowable deflection : 1.146 Actual Deflection : 0.001 in.

The following table is for the Operating Case.

Wind Deflection

		Cumulative	Centroid	Elem. End	Elem. Ang.
--	--	------------	----------	-----------	------------

From	To	Wind Shear lb.	Deflection in.	Deflection in.	Rotation
10	20	3273.54	0.00001	0.00005	...
20	30	2791.64	0.00005	0.00006	...
30	40	2782.53	0.00006	0.00007	...
40	50	2702.30	0.00010719	0.00014651	...
50	60	2461.59	0.00034326	0.00059332	0.00001
60	70	1538.89	0.00070082	0.00081207	0.00001
70	80	1177.84	0.00091335	0.0010163	0.00001
80	90	856.898	0.0011204	0.0012253	0.00001
90	100	535.959	0.0012559	0.0012864	0.00001
100	110	442.887	0.0013482	0.0014099	0.00001
110	120	255.138	0.0014232	0.0014364	0.00001

Critical Wind Velocity for Tower Vibration

From	To	1st Crit. Wind Speed mile/hr	2nd Crit. Wind Speed mile/hr
10	20	431.488	2696.80
20	30	244.744	1529.65
30	40	431.051	2694.07
40	50	431.051	2694.07
50	60	431.051	2694.07
60	70	431.051	2694.07
70	80	431.051	2694.07
80	90	431.051	2694.07
90	100	431.051	2694.07
100	110	431.051	2694.07
110	120	431.102	2694.38

Allowable deflection at the Tower Top (Ope)(6.000"/100ft. Criteria)

Allowable deflection : 1.146 Actual Deflection : 0.001 in.

PV Elite is a trademark of Intergraph CADWorx & Analysis Solutions, Inc. 2011

Basing Calculations :

Step: 16 9:07a Aug 24,2011

Skirt Data :

Skirt Outside Diameter at Base	SOD	120.4740	in.
Skirt Thickness	STHK	0.2370	in.
Skirt Internal Corrosion Allowance	SCA	0.0000	in.
Skirt External Corrosion Allowance		0.0000	in.
Skirt Material		SA-240 304	

Basing Input: Type of Geometry: Simple Basing No Gussets

Thickness of Basing	TBA	0.5000	in.
Design Temperature of the Basing		100.00	F
Basing Matl		SA-36	
Basing Operating All. Stress	BASOPE	16600.00	psi
Basing Yield Stress		36000.00	psi
Inside Diameter of Basing	DI	114.0000	in.
Outside Diameter of Basing	DOU	126.0000	in.
Nominal Diameter of Bolts	BND	1.0000	in.
Bolt Corrosion Allowance	BCA	0.0625	in.
Bolt Material		SA-36	
Bolt Operating Allowable Stress	SA	16600.00	psi
Number of Bolts	RN	8	
Diameter of Bolt Circle	DC	124.0000	in.
Bolt Allowable Shear Stress		15000.000	psi
Are Gussets to be used (Yes/No)	GUSYN	N	
External Corrosion Allowance	CA	0.0000	in.
Dead Weight of Vessel	DW	7143.6	lb.
Operating Weight of Vessel	ROW	133216.1	lb.
Test Weight of Vessel	TW	105652.1	lb.
Earthquake Moment on Basing	EQMOM	228380.5	ft.lb.
Wind Moment on Basing	WIMOM	33512.6	ft.lb.
Test Moment on Basing	TM	75365.6	ft.lb.
Percent Bolt Preload	ppl	100.0	
Use AISC A5.2 Increase in Fc and Bolt Stress		No	
Use Allowable Weld Stress per AISC J2.5		No	
Factor for Increase of Allowables	Fact	1.0000	

Results for Basing Analysis : Analyze Option

Basing Thickness Calculation method used : Simplified (Steel on Steel)

Calculation of Load per Bolt [W/Bolt], Wind + Dead Weight Condition:

W = DW M = WIMOM

$$= ((4 * M/DC) - W) / RN \text{ per Jawad \& Farr, Eq. 12.3}$$

$$= ((4 * 402150 / 124.000) - 7143) / 8$$

$$= 728.6279 \text{ lb.}$$

Required Area for Each Bolt, Based on Max Load	0.0439	sq.in.
Area Available in a Single Bolt (Corr)	0.3988	sq.in.
Area Available in all the Bolts (Corr)	3.1905	sq.in.
Bolt Stress Based on Simplified Analysis	1827.0	psi
Allowable Bolt Stress 16600.0 [Fact]	16600.00	psi

Shear Stress in a Single Bolt [taub]:

$$\begin{aligned}
 &= \text{Shear Force} / (2 * \text{Bolt Area} * \text{Number of Bolts}) \\
 &= 24644 / (2 * 0.40 * 8) \\
 &= 3862.3 \text{ psi. Must be less than } 15000.0 \text{ psi}
 \end{aligned}$$

Concrete Contact Area of Base Ring CCA 2261.95 sq.in.
 Concrete Contact Section Modulus of Base Ring 64788.62 in.³

Concrete Load (Simplified method), Earthquake in Operating Condition [Sc]:

$$\begin{aligned}
 &= ((ppl/100 * (Abt * Sa) + W) / Cca) + M/CZ \text{ per Jawad \& Farr Eq. 12.1} \\
 &= (1.000 (3.1905 * 16600 + 139743) / 2261.95) + 2740566 / 64788.62 \\
 &= 127.49 \text{ psi}
 \end{aligned}$$

Allowable Stress on Concrete 1200.00 psi

Determine Maximum Bending Width of Basing Section [Rw1,Rw2]:

$$\begin{aligned}
 Rw1 &= (Dou - SkirtOD) / 2, \quad Rw2 = (SkirtID - Di + 2 * Sca) / 2 \\
 Rw1 &= (126.000 - 120.474) / 2, \quad Rw2 = (120.000 - 114.000 + 2 * 0.000) / 2 \\
 Rw1 &= 2.763, \quad Rw2 = 3.000 \text{ in.}
 \end{aligned}$$

Calculation of required Basing Thickness, (Simplified) [Tb]:**Allowable Bending Stress 1.5 Basope = 24900.000 psi**

$$\begin{aligned}
 &= \text{Max}(Rw1, Rw2) * (3 * Sc / S)^{1/2} + CA \text{ per Jawad \& Farr Eq. 12.12} \\
 &= \text{Max}(2.7630, 3.0000) * (3 * 127.495 / 24900.000)^{1/2} + 0.0000 \\
 &= 0.3718 \text{ in.}
 \end{aligned}$$

Basing Stress at given Thickness [Sb]

$$\begin{aligned}
 &= 3 * Sc * (\text{Max}[Rw1, Rw2] / (Tb - Ca))^2 \\
 &= 3 * 127.495 * (\text{Max}[2.763, 3.000] / (0.500 - 0.000))^2 \\
 &= 13769.441, \text{ must be less than } 24900.000 \text{ psi}
 \end{aligned}$$

Summary of Basing Thickness Calculations:

Required Basing Thickness (simplified) 0.3718 in.
 Actual Basing Thickness as entered by user 0.5000 in.

Weld Size Calculations per Steel Plate Engineering Data - Vol. 2**Compute the Weld load at the Skirt/Base Junction [W]**

$$\begin{aligned}
 &= \text{SkirtStress} * (\text{SkirtThickness} - CA) \\
 &= 2435.571 * (0.237 - 0.000) \\
 &= 577.23 \text{ lb./in.}
 \end{aligned}$$

Results for Computed Minimum Basing Weld Size [BWeld]

$$\begin{aligned}
 &= W / [(0.4 * \text{Yield}) * 2 * 0.707] \\
 &= 577 / [(0.4 * 26700) * 2 * 0.707] \\
 &= 0.038 \text{ in.}
 \end{aligned}$$

Summary of Required Weld Sizes:

Required Basing to Skirt Double Fillet Weld Size 0.1875 in.

REPORT NO. DEAC-TR-1473	REV. NO.	PROJECT NO. CBE-11-001	PAGE 61
----------------------------	----------	---------------------------	-------------------

APPENDIX C

E-Mails from

Chavond-Barry Engineering

Send reply to: <kemonninger@chavond-barry.com>
From: "Karl Monninger" <kemonninger@chavond-barry.com>
To: "Al Errett" <Errett@DEAC.com>
Subject: Tank Structural Analysis RFP
Date sent: Fri, 6 May 2011 17:01:08 -0400
Organization: Chavond-Barry Engineering Corp.

Al,

It was my pleasure to meet you over the phone today.

As discussed, I would like to obtain structural analysis for 4 identical storage tanks located at a facility in Parker, AZ (see attached sketches). The tanks were fabricated by Wyatt M&B works, Inc. in 1956 and the mat'l of construction is 300 series stainless steel (specific grade unknown). Minimum thickness of the cylindrical shell (0.176"), conical bottom (0.167"), umbrella roof (0.183") and support skirt (0.237") for all tanks were measured by ultrasonic testing. The two carbon steel stiffener angle rings (2-1/2" x 2-1/2" x 3/16") on the shell of each tank are new. The bottom of the carbon steel skirt support for each tank is anchored by means of eight 1-inch diameter bolts.

The tanks are used for storage of activated carbon/water slurry and operate at atmospheric pressure and a temperature of ?150°F. Each tank is equipped with a 4" diam. atmospheric vent and a 3" diam. pressure safety valve with vacuum breaker (set @ 8 oz for pressure relief & @ 6 oz. for vacuum).

The calculation should use current IBC criteria for wind (75 mph) and seismic loading (zone 2) and requires PE seal. If the minimum thickness for any of these tank components adversely impact tank integrity, we would require an additional calculation to determine the minimum acceptable thickness required for that component. Please provide us with a proposal for the calculations at your earliest convenience. Please contact me by phone or reply email if you should require additional information to determine cost and schedule.

Thanks,

Karl

Karl E. Monninger

Vice President

Chavond-Barry Engineering Corporation

400 County Route 518

P.O. Box 205

Blawenburg, New Jersey 08504

Phone: (609) 466-4900 x202

Fax: (609) 466-1231

Cell: (609) 468-0176

KEMonninger@Chavond-Barry.com

Alan Errett**Wednesday, June 29, 2011**

Send reply to: <kemonninger@chavond-barry.com>
From: "Karl Monninger" <kemonninger@chavond-barry.com>
To: "'Alan Errett'" <errett@deac.com>
Subject: RE: Tank Structural Analysis RFP
Date sent: Wed, 29 Jun 2011 11:02:49 -0400
Organization: Chavond-Barry Engineering Corp.

Alan,

Please proceed with structural calculations for the T-tanks. Attached for your reference are copies of the original calculations for T-1, T-2, T-5 and T-6 (revised 2/24/94), and more recent IBC and AWWA wind and seismic design loading calculations (dated 2/9/07) for another tank at the facility that is not part of the current evaluation.

The two existing carbon steel vacuum stiffener angle rings on each tank were originally rolled from 2-1/2" X 2-1/2" X 1/4" stock, not 3/16" thickness as indicated on the sketch sent with our RFP. Most of these existing rings are badly corroded at the top corner of the angle in several locations such that the material remaining with any hoop integrity is nominally 2-1/2" X 1/4". Use a 2" X 1/4" flat bar (0.5 in.² CSA) in lieu of the 2-1/2" X 2-1/2" X 1/4" angle as per the 1994 calculations is still applicable (conservative). The new 2-1/2" X 2-1/2" X 3/16" carbon steel stiffener angle rings have been installed 21-1/2" above the existing stiffener rings on all tanks (see attached Revised T-Tank Sketch.pdf).

If you have any questions, please don't hesitate to contact me at your earliest convenience. Thank you.

Karl E. Monninger

Vice President

Chavond-Barry Engineering Corporation

400 County Route 518

P.O. Box 205

Blawenburg, New Jersey 08504

Phone: (609) 466-4900 x202

Fax: (609) 466-1231

Cell: (609) 468-0176

KEMonninger@Chavond-Barry.com

APPENDIX D

TANK SUPPORT STRUCTURE AND FOUNDATION DRAWINGS

LuMar Engineering

(818) 568-8553

DATE 3-18-92

BY jmd CHKD.

SUBJECT

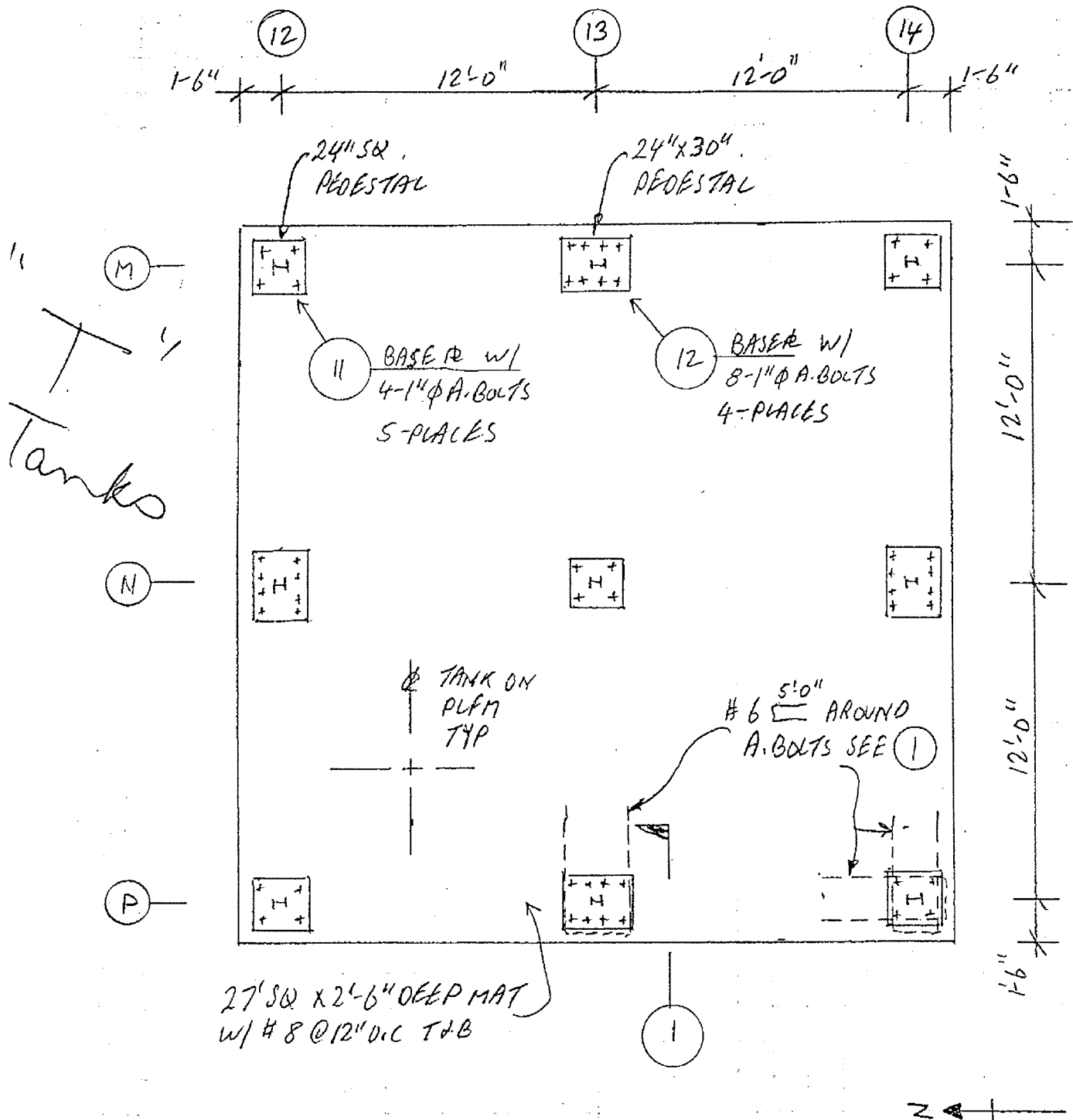
WESTATES
241SQ PLFM

100 E. DEL MAR BLVD. SUITE 108
PASADENA, CA. 91105

SHEET NO.

B1 of 6

JOB NO.



STORAGE TANKS PLFM FOUNDATION

(3/16" = 1 FT)

REV A 3/19/92

REF DWG D9201-201 REV A BY GMG

B1

LuMar Engineering

(818) 568-8553

DATE 3-18-92

SUBJECT

WESTATES
24' SQ PLFM

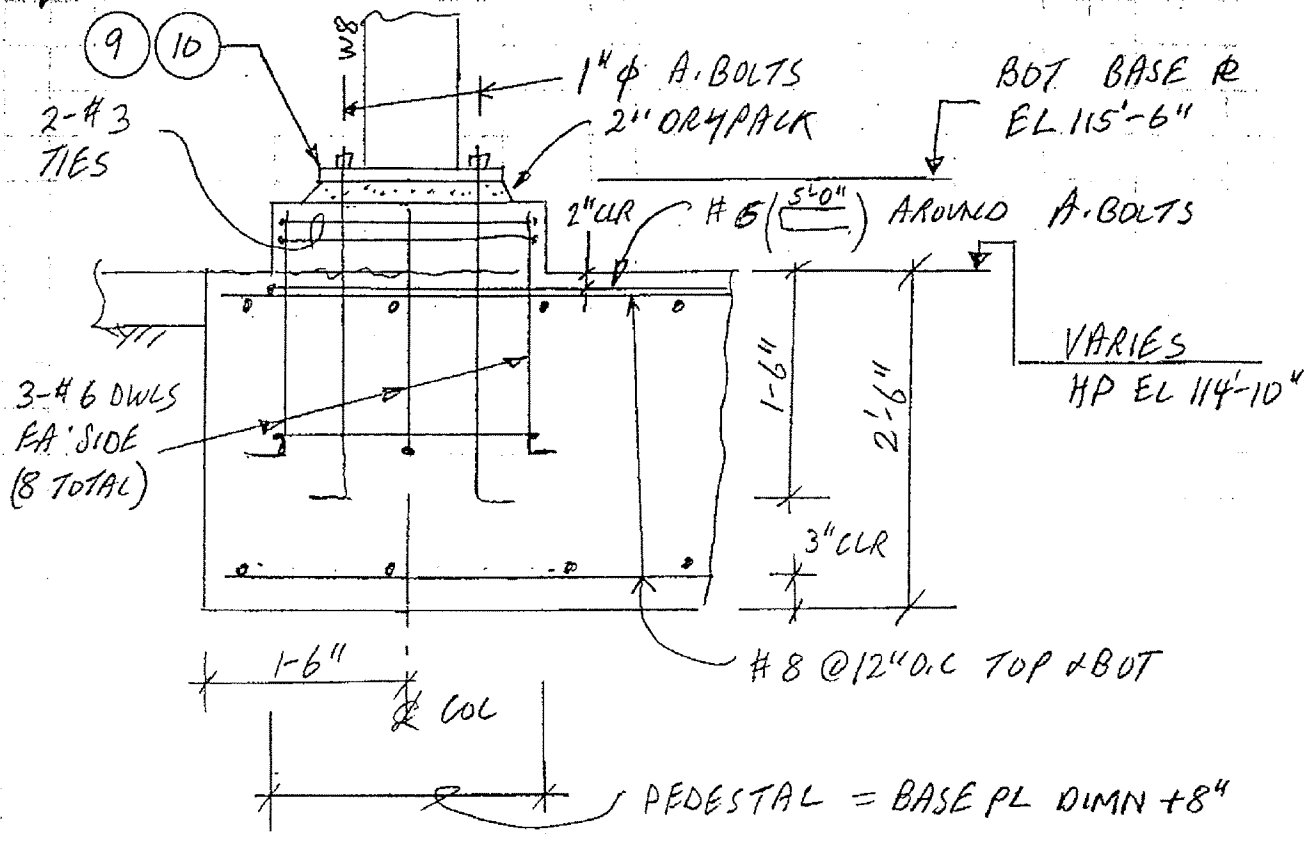
BY JMD CHKD.

10 E. DEL MAR BLVD. SUITE 108

PASADENA, CA. 91105

SHEET NO. B2 of 6

JOB NO.



1 3/4" = 1 FT

NOTES

1. SEE NOTES ON S-X DRAWINGS FOR BUILDING.
2. CONCRETE 3000 PSI AT 28 DAYS (DESIGN $f'_c = 2500$)
3. REBAR ASTM A615 GRADE 60

REV A 3/19/92

B2

LuMar Engineering

(818) 568-8553

DATE 3-16-92

BY *gnd* CHKD.

SUBJECT

WESTATES
24' DIA PLFM

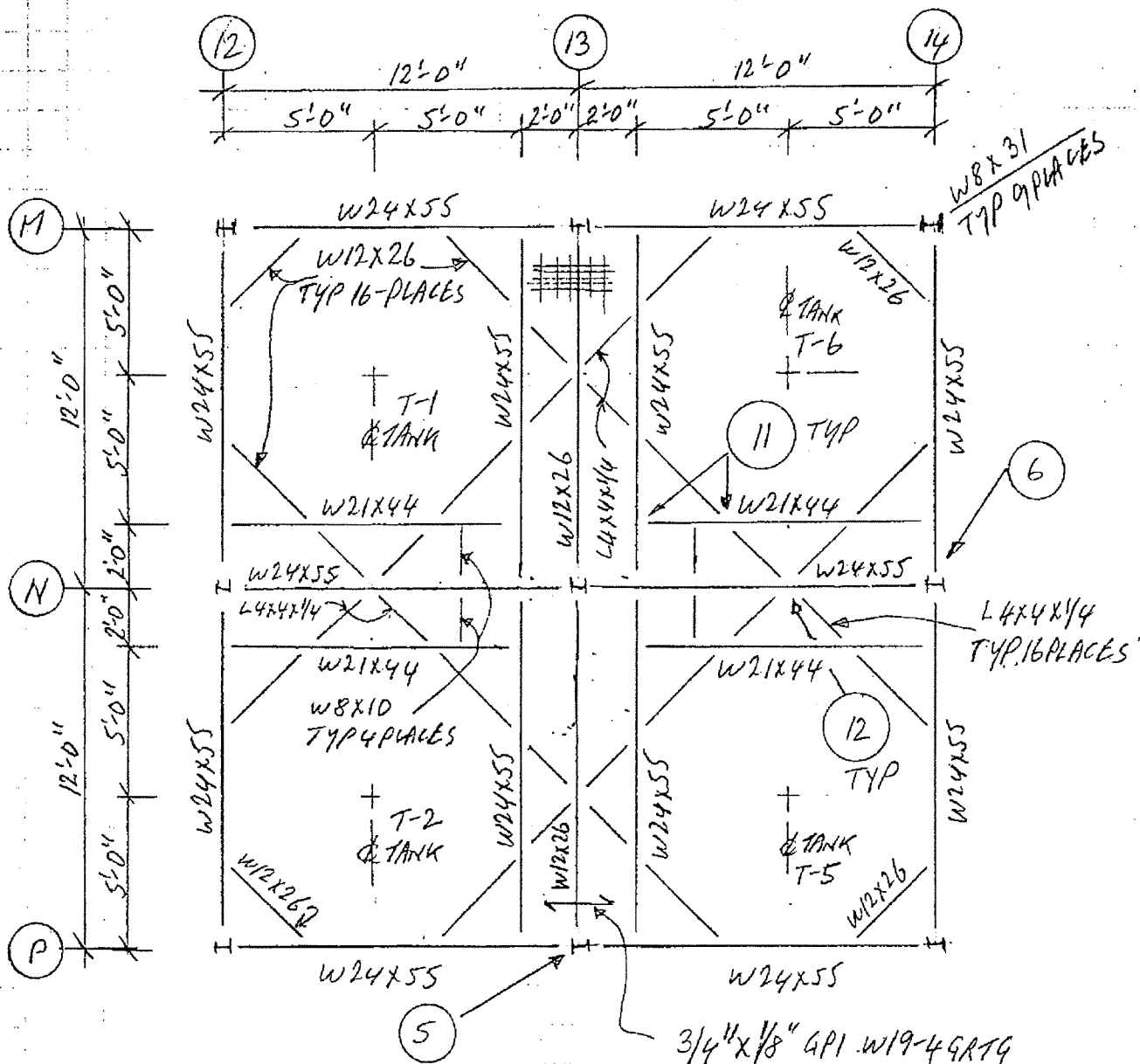
10 E. DEL MAR BLVD. SUITE 108

PASADENA, CA. 91105

SHEET NO.

B3 of 6

JOB NO.



STORAGE TANKS PLFM

(3/16" = 1 FT)

PLFM EL 126'-11 1/4"

TOS EL 126'-10 1/2"

NOTE

TANK OPER WT = 142,400 #

REV. A 3/19/92

REF DWG 09201-201 REV A BY GmG

B3

LuMar Engineering
(818) 568-8553

DATE 3-18-92

BY JMD CHKD.

SUBJECT

WESTATES

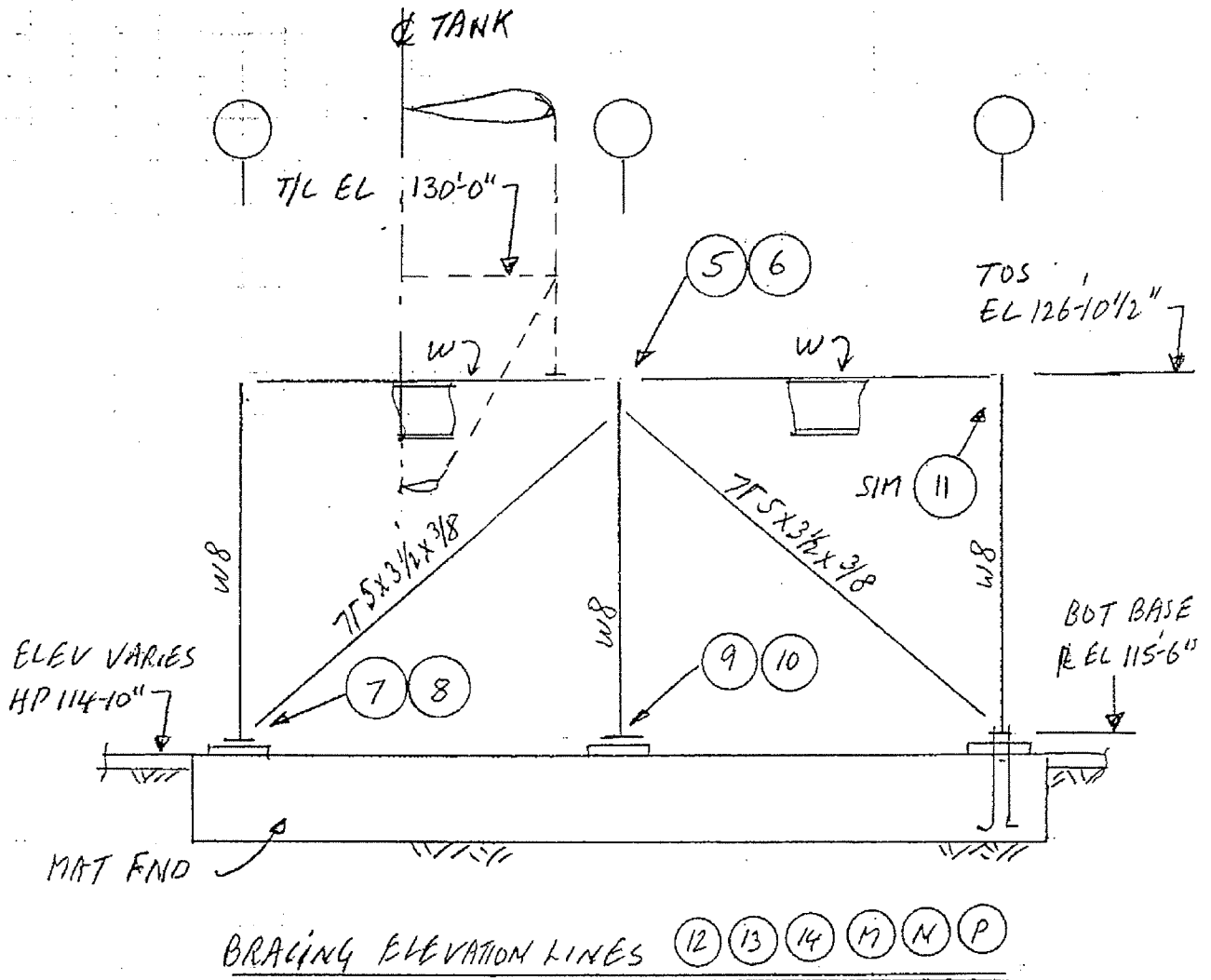
24' SQ PLFM

100 E. DEL MAR BLVD. SUITE 108
PASADENA, CA. 91105

SHEET NO.

B476

JOB NO.



NOTES

1. SEE NOTES ON S-X DRAWINGS FOR BUILDING
2. STEEL SHAPES & PLATES : ASTM A36
BOLTS : ASTM A325.

REV A 3/19/92

B4

LuMar Engineering

(818) 568-8553

DATE 3-18-92

BY *mo* CHKD.

SUBJECT

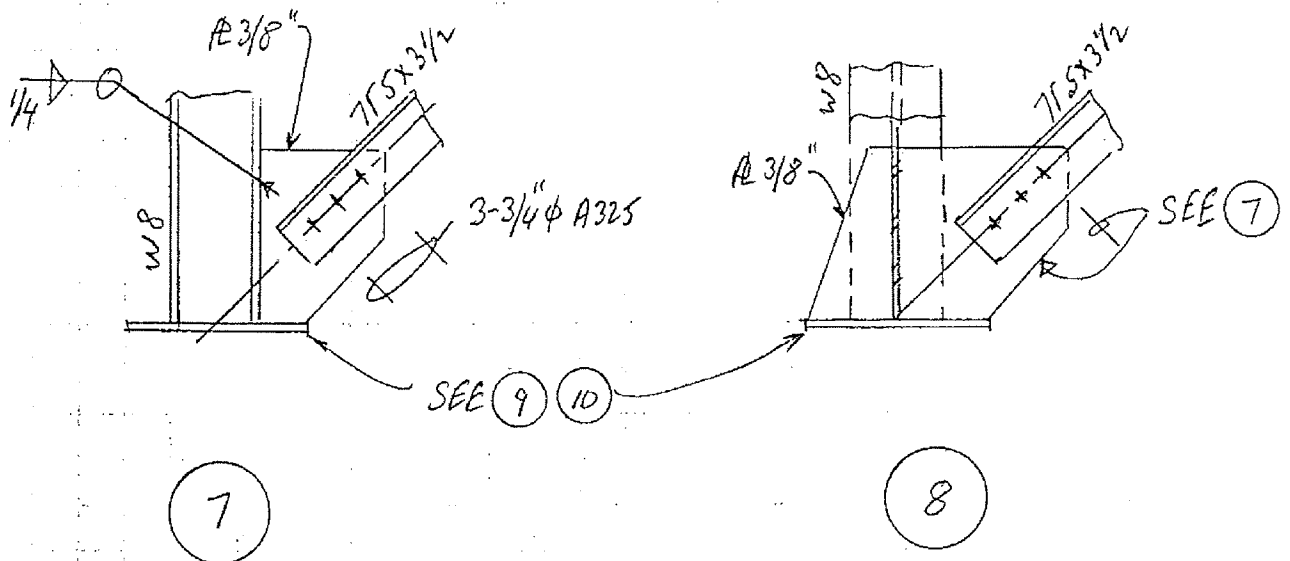
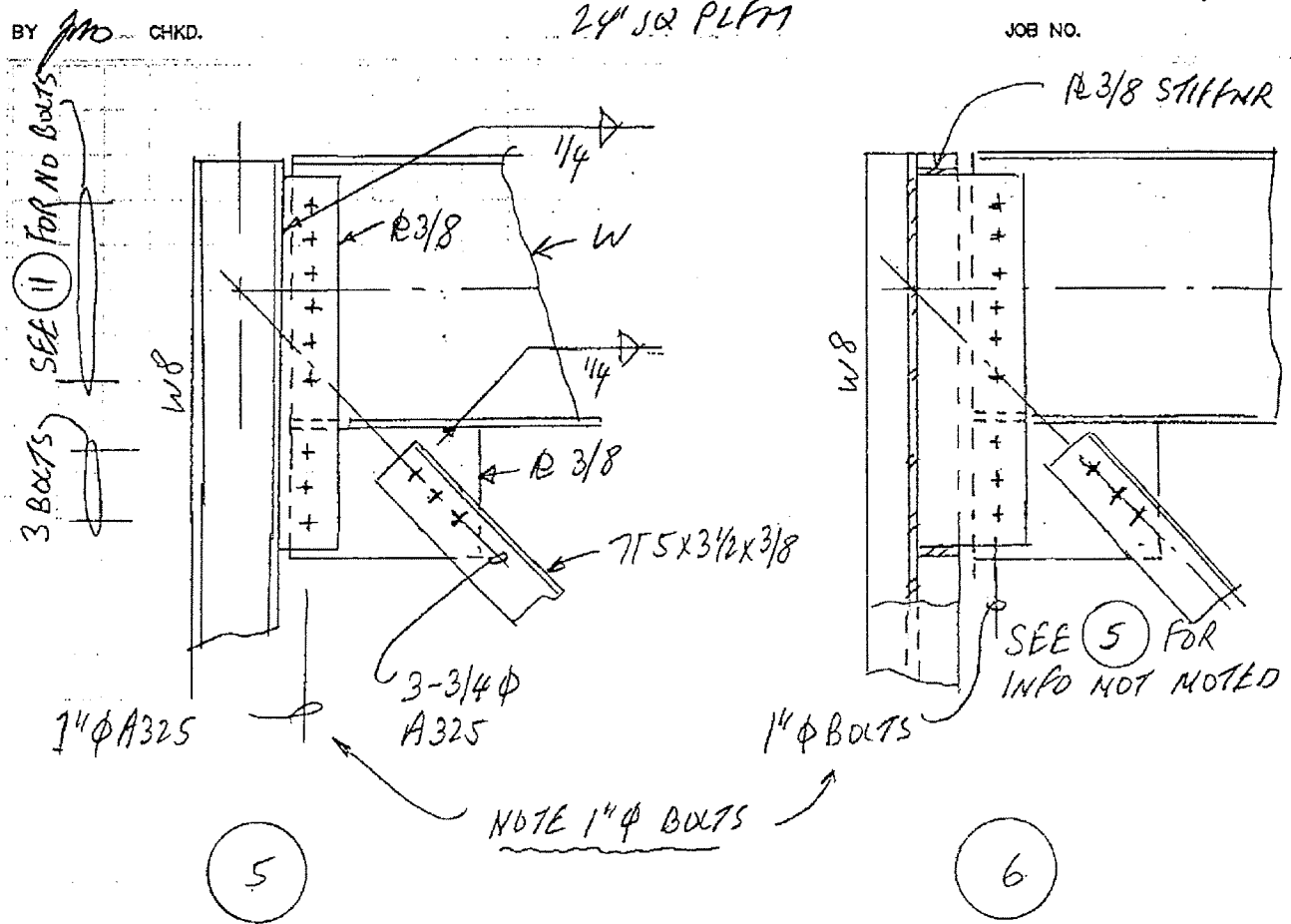
WESTATES
24" SQ PLFM

100 E. DEL MAR BLVD. SUITE 108

PASADENA, CA. 91105

SHEET NO. B5Q6

JOB NO.



REV A 3/19/92

B5

LuMar Engineering
(818) 568-8553

700 E. DEL MAR BLVD. SUITE 108
PASADENA, CA. 91105

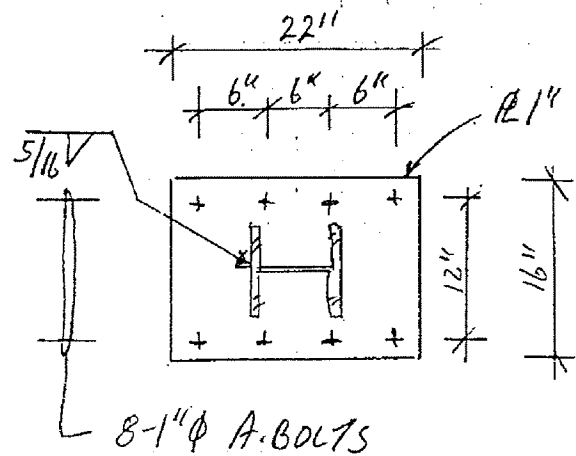
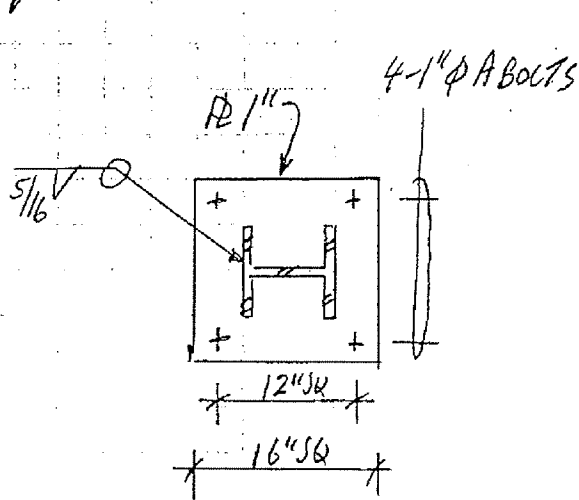
DATE 3-18-92

SUBJECT WESTATES

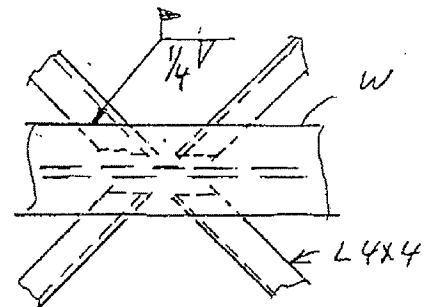
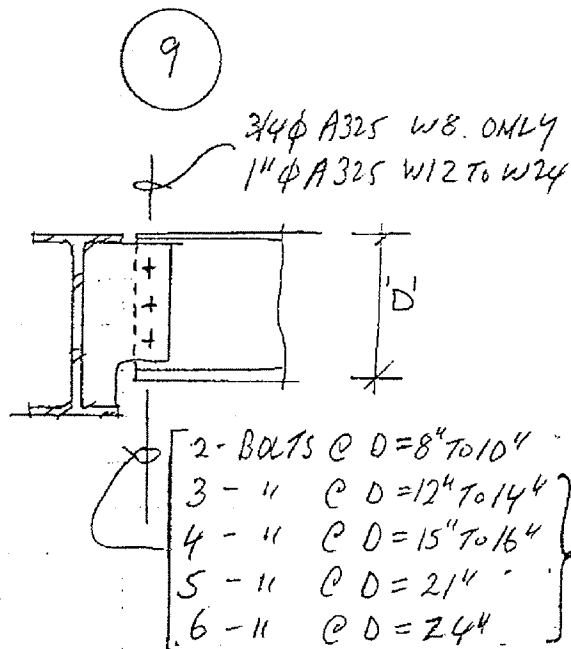
SHEET NO. B606

BY *mw* CHKD.

JOB NO.



BASE @ AT
B-13, P-13
N-12 N-14



NOTE 1"φ BOLTS

REV A 3/19/92

B6

APPENDIX IX

TAB 2

Assessment of Tank System T-18

Revision 1
April 2012

**NEW TANK SYSTEM ENGINEERING ASSESMENT
FOR
FURNACE FEED TANK T-18**

LOCATED AT

**SIEMENS WATER TECHNOLOGIES CORP.
25323 MUTAHAR ST.
PARKER, ARIZONA 85344**



CHAVOND-BARRY ENGINEERING CORP.

400 County Route 518 • P.O. Box 205
Blawenburg, New Jersey 08504-0205

Tel: (609) 466-4900
Fax: (609) 466-1231

New Tank System Engineering Assessment

I have reviewed design information relating to the new above ground tank system shown as Furnace Feed Tank T-18 on the plans attached as Exhibit A, which is to be installed at the Siemens facility in Parker, Arizona, and my assessment allows me to draw the following conclusions in accordance with 40 CFR 264.192(a):

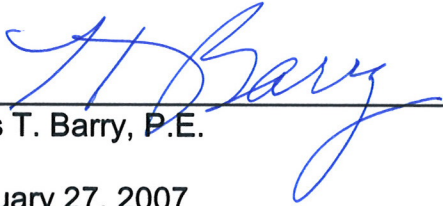
1. The tank system has sufficient structural integrity and is acceptable for the storing and treating of hazardous waste.
2. The tank system foundation, structural support, seams, connections and pressure controls (where applicable) are adequately designed.
3. The tank system has sufficient structural strength, compatibility with the wastes to be stored or treated, and corrosion protection, to ensure that it will not collapse, rupture or fail.

My assessment has been based, in part, on my review of the following information, which is attached as noted:

- A. Design standards for tank system construction (Exhibit B).
- B. Hazardous characteristics of the wastes to be handled in the tank system (Exhibit C).
- C. Information that there will be no external metal component of the tank system that will be in contact with the soil or with water (Exhibit D).
- D. Design considerations to ensure that (i) tank foundations will maintain the load of a full tank, (ii) anchoring will prevent flotation or dislodgment where the tank system is placed in a saturated zone or in a seismic fault zone subject to the standards of 40 CFR 264.18(a), and (iii) the tank system will withstand the effects of frost heave.

In accordance with 40 CFR 264.192(a) and 40 CFR 270.11(d), I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or

persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



Louis T. Barry, P.E.

February 27, 2007

Attachments:

- Exhibit A - Plans
- Exhibit B - Design Standards
- Exhibit C - Hazardous Waste Characteristics
- Exhibit D - Information on Metal Components



**SIEMENS WATER TECHNOLOGIES CORP.
PARKER, ARIZONA**

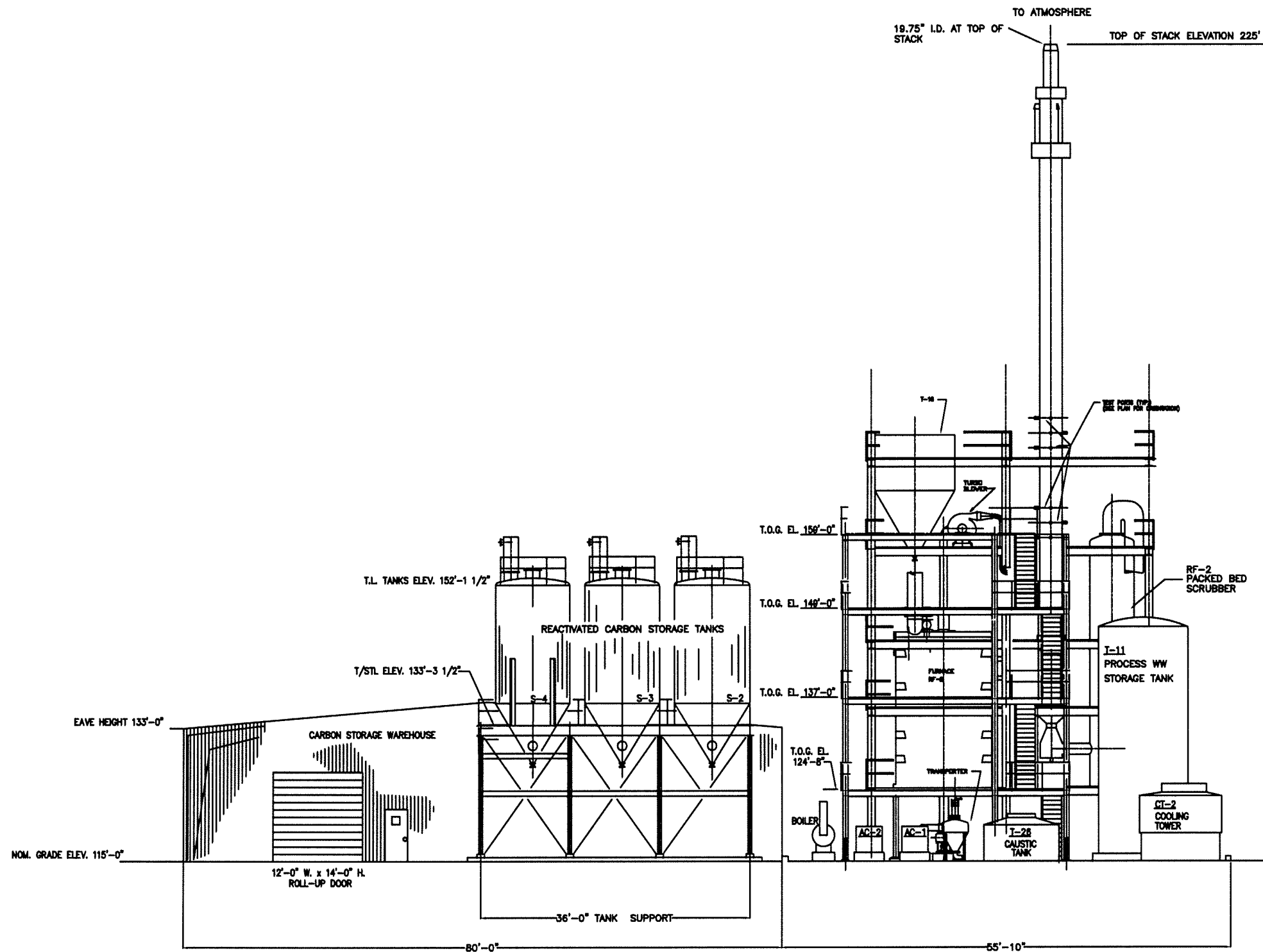
**NEW TANK SYSTEM ENGINEERING ASSESMENT
FOR
FURNACE FEED TANK T-18**

Attachments

1. Exhibit A - Plans
 - A. T-18 Plan and Elevation Drawings
 - B. T-18 Fabrication Drawings
 - C. T-18 Support Steel Drawings
2. Exhibit B - Design Standards
 - A. Structural Calculations for T-18
 - B. Structural Calculations for T-18 Support Steel
3. Exhibit C - Hazardous Waste Characteristics
 - A. Table 1 - EPA Listed Hazardous Wastes
 - B. Table 2 – Spent Activated Carbon Organic Constituents
 - C. Table 3 - Spent Activated Carbon Characterization
4. Exhibit D – Information on Metal Components

Exhibit A - Plans

T-18 Plan and Elevation Drawings



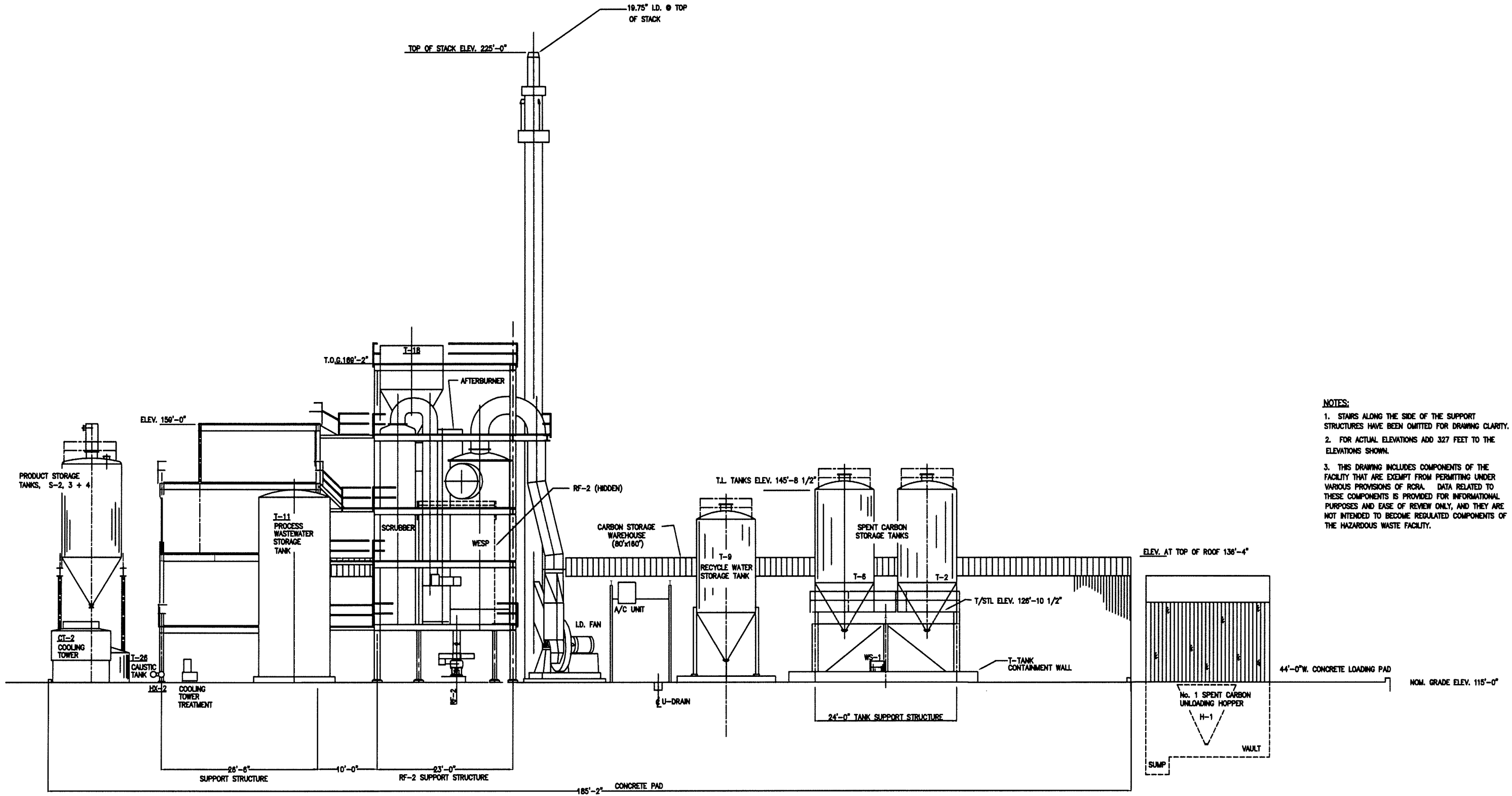
OVERALL SITE VIEW LOOKING NORTHWEST

NOTES:

1. THIS DRAWING INCLUDES COMPONENTS OF THE FACILITY THAT ARE EXEMPT FROM PERMITTING UNDER VARIOUS PROVISIONS OF RCRA. DATA RELATED TO THESE COMPONENTS IS PROVIDED FOR INFORMATIONAL PURPOSES AND EASE OF REVIEW ONLY, AND THEY ARE NOT INTENDED TO BECOME REGULATED COMPONENTS OF THE HAZARDOUS WASTE FACILITY.
2. FOR ACTUAL ELEVATIONS ADD 327 FEET TO THE ELEVATIONS SHOWN.

2	1/18/07	UPDATED FOR PERMIT SUBMITTAL	JBE	KEM	
1	7/18/02	REVISED FOR RCRA PART B PERMIT APPLICATION	STA	KEM	
REV.	DATE	REVISION DESCRIPTION	DRAWN	CHK'D	ENG'R
CUSTOMER:					
SIEMENS WATER TECHNOLOGIES CORP			SIEMENS WATER TECHNOLOGIES CORP.		
LOCATION:			Parker, AZ		
2523 MUTAHAR ST.			TITLE:		
PARKER, AZ 85344			REACTIVATION FACILITY		
PROJECT No. 11135			OVERALL ARRANGEMENTS		
DRAWN: CPG 4/21/04			PART No.		
CHK'D:			DWG No. D14789-04		
ENG'R:			REV. 2		

PLOT SCALE: NONE
DO NOT SCALE DRAWING
THIS DRAWING IS THE PROPERTY OF SIEMENS AND CANNOT BE REPRODUCED OR DELIVERED TO OTHERS WITHOUT THE EXPRESS WRITTEN PERMISSION OF SIEMENS WATER TECHNOLOGIES CORP.

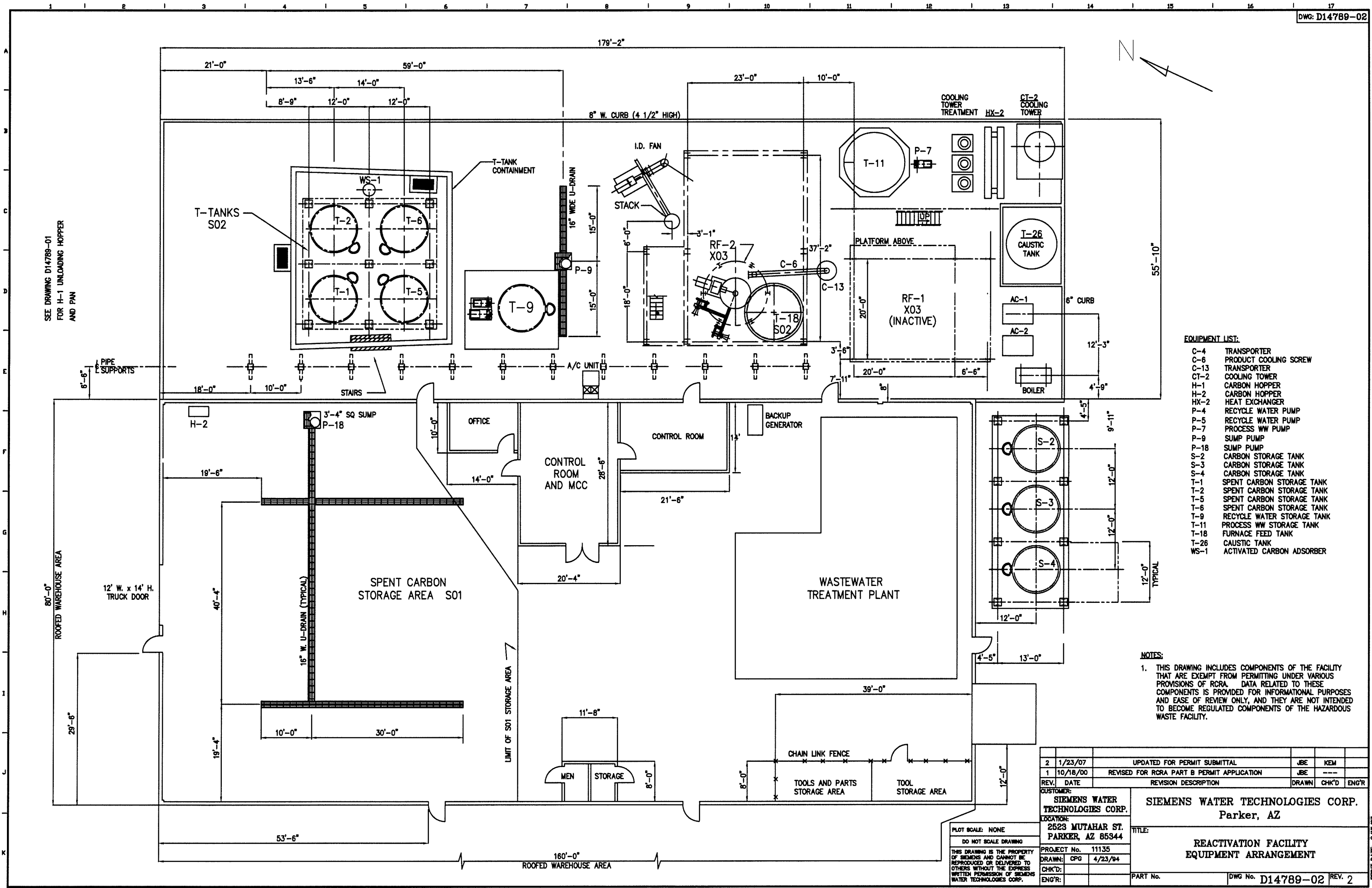


OVERALL SITE VIEW LOOKING SOUTHWEST

- NOTES:
1. STAIRS ALONG THE SIDE OF THE SUPPORT STRUCTURES HAVE BEEN OMITTED FOR DRAWING CLARITY.
 2. FOR ACTUAL ELEVATIONS ADD 327 FEET TO THE ELEVATIONS SHOWN.
 3. THIS DRAWING INCLUDES COMPONENTS OF THE FACILITY THAT ARE EXEMPT FROM PERMITTING UNDER VARIOUS PROVISIONS OF RCRA. DATA RELATED TO THESE COMPONENTS IS PROVIDED FOR INFORMATIONAL PURPOSES AND EASE OF REVIEW ONLY, AND THEY ARE NOT INTENDED TO BECOME REGULATED COMPONENTS OF THE HAZARDOUS WASTE FACILITY.

PLOT SCALE: NONE
DO NOT SCALE DRAWING
THIS DRAWING IS THE PROPERTY OF SIEMENS WATER TECHNOLOGIES CORP. AND CANNOT BE REPRODUCED OR DELIVERED TO OTHERS WITHOUT THE EXPRESS WRITTEN PERMISSION OF SIEMENS WATER TECHNOLOGIES CORP.

2	1/18/07	UPDATED FOR PERMIT SUBMITTAL	JBE	KEM	
1	7/24/02	REVISED FOR RCRA PART B PERMIT APPLICATION	CPG	KEM	
REV.	DATE	REVISION DESCRIPTION	DRAWN	CHK'D	ENG'R
CUSTOMER:			SIEMENS WATER TECHNOLOGIES CORP.		
LOCATION:			Parker, AZ		
PROJECT No.			TITLE:		
DRAWN: CPG			REACTIVATION FACILITY		
CHK'D: 4/21/04			SITE VIEW		
ENG'R:			OVERALL ARRANGEMENTS		
PART No.			DWG No. D14789-03		
			REV. 2		



SEE DRAWING D14789-01
FOR H-1 UNLOADING HOPPER
AND PAN

- EQUIPMENT LIST:**
- C-4 TRANSPORTER
 - C-6 PRODUCT COOLING SCREW
 - C-13 TRANSPORTER
 - CT-2 COOLING TOWER
 - H-1 CARBON HOPPER
 - H-2 CARBON HOPPER
 - HX-2 HEAT EXCHANGER
 - P-4 RECYCLE WATER PUMP
 - P-5 RECYCLE WATER PUMP
 - P-7 PROCESS WW PUMP
 - P-9 SUMP PUMP
 - P-18 SUMP PUMP
 - S-2 CARBON STORAGE TANK
 - S-3 CARBON STORAGE TANK
 - S-4 CARBON STORAGE TANK
 - T-1 SPENT CARBON STORAGE TANK
 - T-2 SPENT CARBON STORAGE TANK
 - T-5 SPENT CARBON STORAGE TANK
 - T-6 SPENT CARBON STORAGE TANK
 - T-9 RECYCLE WATER STORAGE TANK
 - T-11 PROCESS WW STORAGE TANK
 - T-18 FURNACE FEED TANK
 - T-26 CAUSTIC TANK
 - WS-1 ACTIVATED CARBON ADSORBER

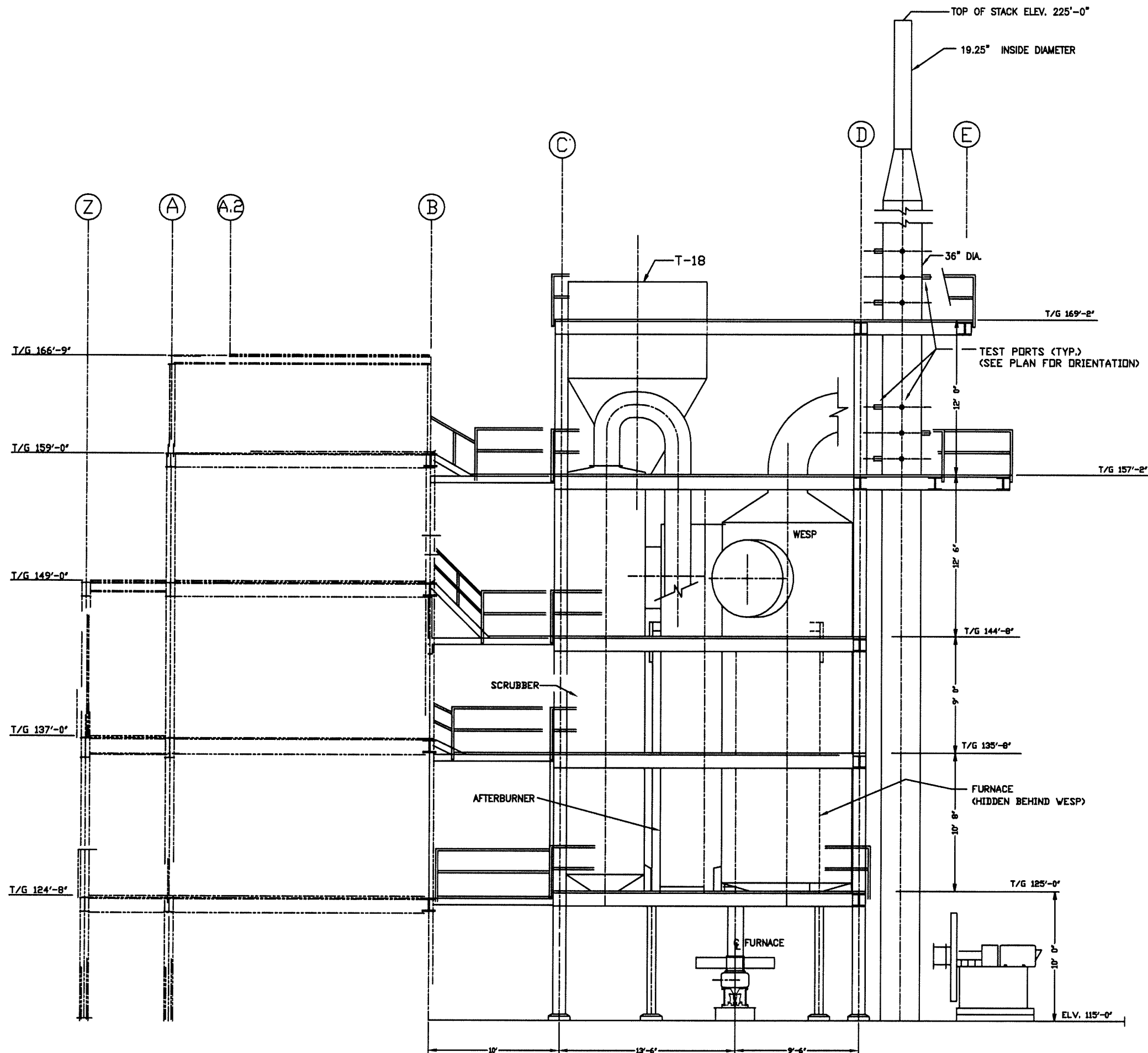
NOTES:

1. THIS DRAWING INCLUDES COMPONENTS OF THE FACILITY THAT ARE EXEMPT FROM PERMITTING UNDER VARIOUS PROVISIONS OF RCRA. DATA RELATED TO THESE COMPONENTS IS PROVIDED FOR INFORMATIONAL PURPOSES AND EASE OF REVIEW ONLY, AND THEY ARE NOT INTENDED TO BECOME REGULATED COMPONENTS OF THE HAZARDOUS WASTE FACILITY.

2	1/23/07	UPDATED FOR PERMIT SUBMITTAL	JBE	KEM	
1	10/18/00	REVISED FOR RCRA PART B PERMIT APPLICATION	JBE	---	
REV.	DATE	REVISION DESCRIPTION	DRAWN	CHK'D	ENG'R
CUSTOMER:			SIEMENS WATER TECHNOLOGIES CORP.		
LOCATION:			2523 MUTAHAR ST. PARKER, AZ 85344		
PROJECT No.			11135		
DRAWN:			CPG 4/23/04		
CHK'D:					
ENG'R:					
TITLE:			REACTIVATION FACILITY EQUIPMENT ARRANGEMENT		
PART No.			DWG No. D14789-02 REV. 2		

PLOT SCALE: NONE
DO NOT SCALE DRAWING
THIS DRAWING IS THE PROPERTY OF SIEMENS AND CANNOT BE REPRODUCED OR DELIVERED TO OTHERS WITHOUT THE EXPRESS WRITTEN PERMISSION OF SIEMENS WATER TECHNOLOGIES CORP.

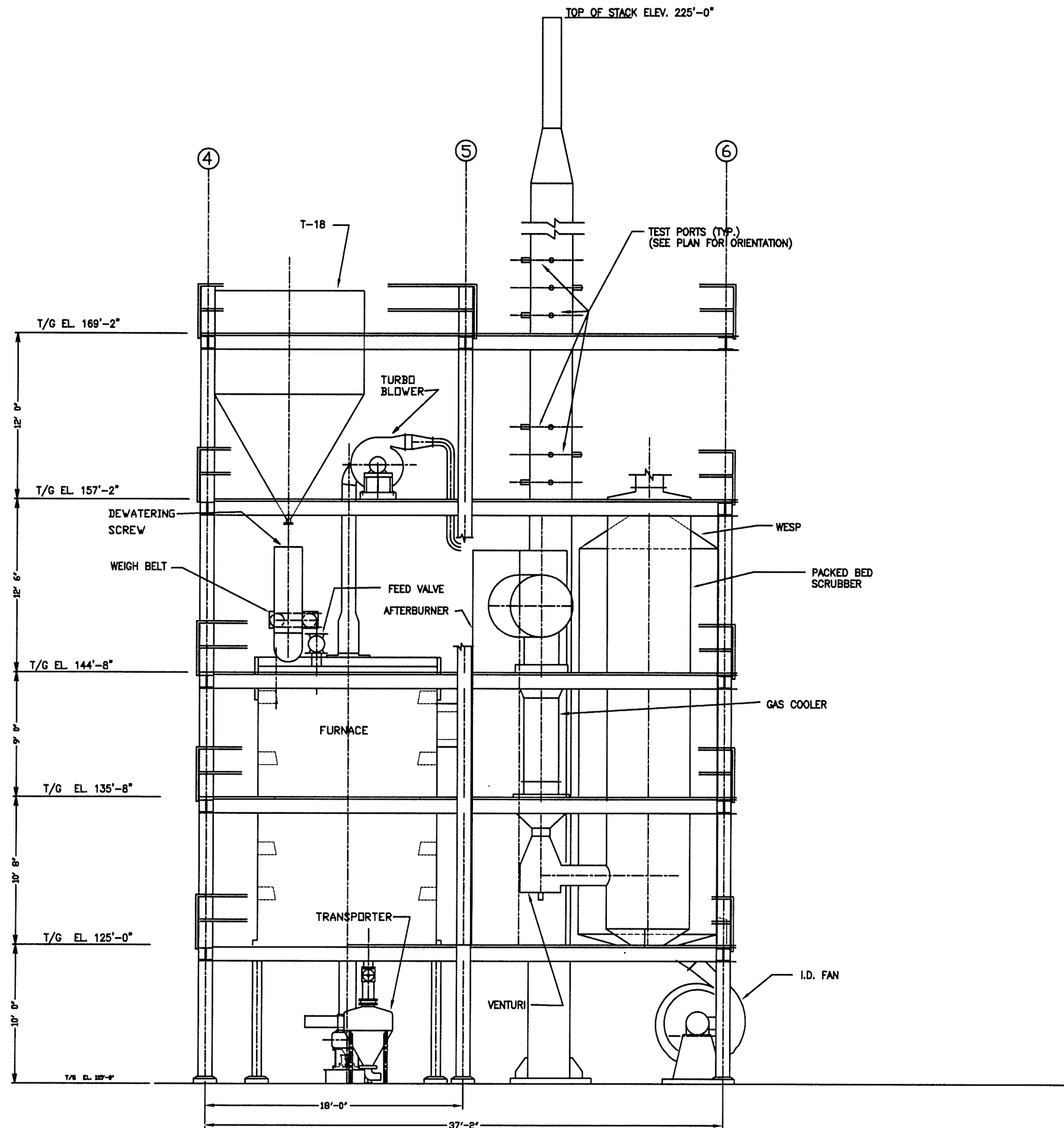
PRINT DATE: 2/15/07



NOTES:

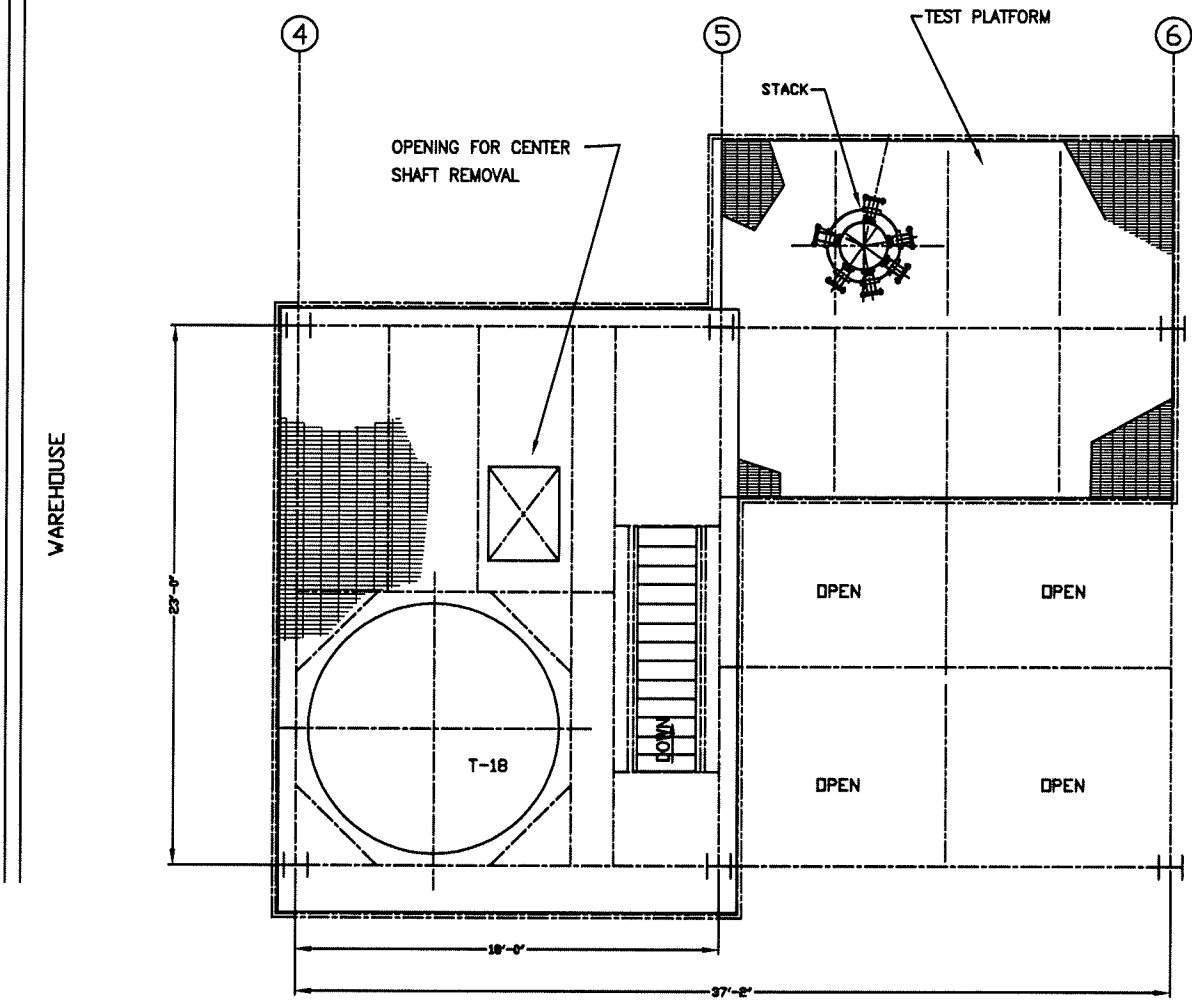
1. THIS DRAWING INCLUDES COMPONENTS OF THE FACILITY THAT ARE EXEMPT FROM PERMITTING UNDER VARIOUS PROVISIONS OF RCRA. DATA RELATED TO THESE COMPONENTS IS PROVIDED FOR INFORMATIONAL PURPOSES AND EASE OF REVIEW ONLY, AND THEY ARE NOT INTENDED TO BECOME REGULATED COMPONENTS OF THE HAZARDOUS WASTE FACILITY.
2. STAIRS ALONG THE SIDE OF THE SUPPORT STRUCTURES HAVE BEEN OMITTED FOR DRAWING CLARITY.
3. FOR ACTUAL ELEVATIONS ADD 327 FEET TO THE ELEVATIONS SHOWN.

NO	DWN	CK'D	APP	REVISIONS	DATE
CBE CHAVOND-BARRY ENGINEERING CORP. 400 Route 518 • P.O. Box 205 • Blawenburg, New Jersey 08504					
SIEMENS WATER TECHNOLOGIES CORP. 2523 MUTAHAR STREET, PARKER, AZ 85344 CARBON REGENERATION SYSTEM					
ELEVATION LOOKING WEST					
DRAWN		CHECKED		APPROVED	
CPG		KEM			
DATE		DATE		DATE	
5/12/94		5/13/94			
SCALE		DWG. NO.		REV.	
1/4" = 1'-0"		1478-P-005		0	

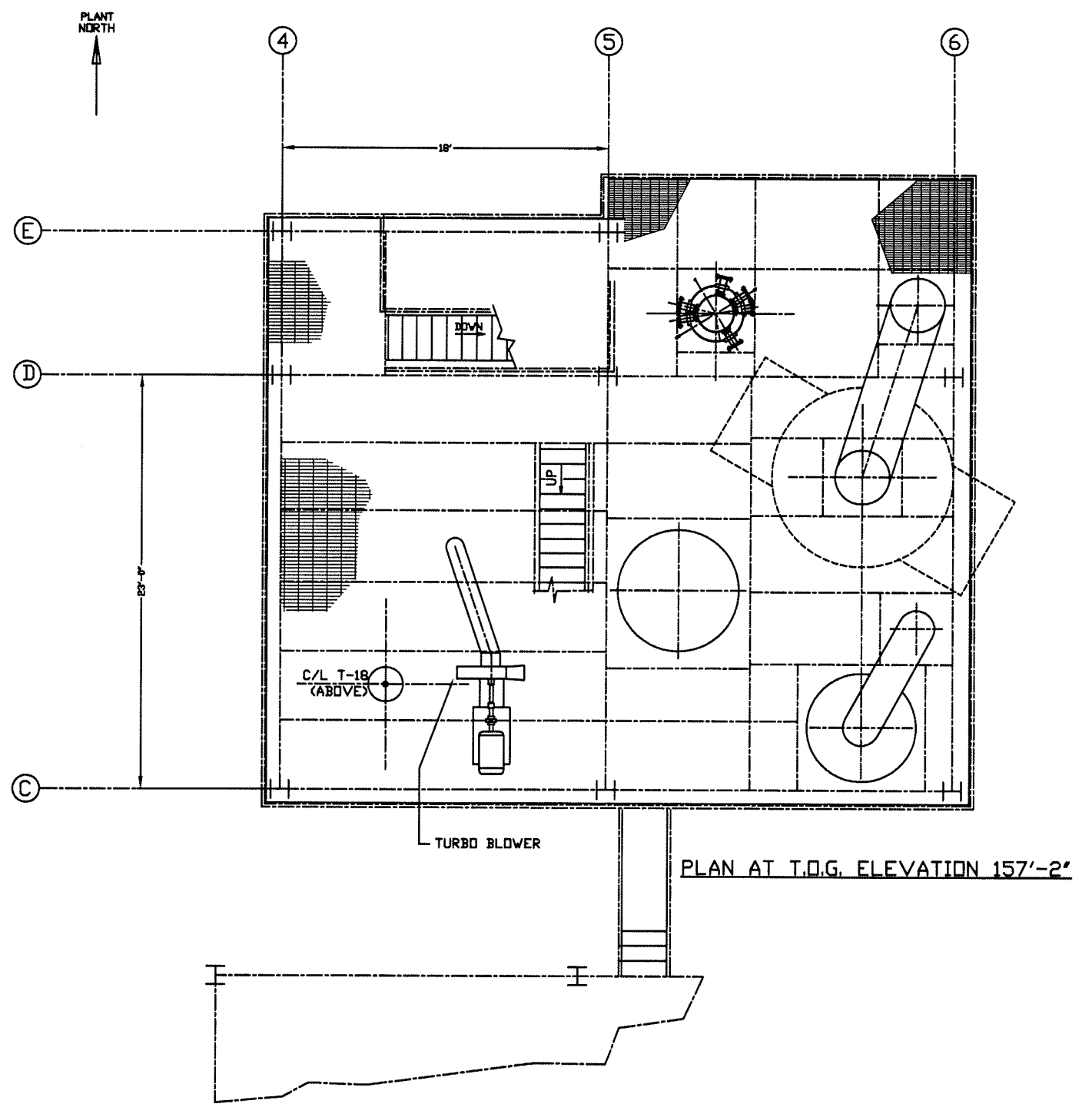
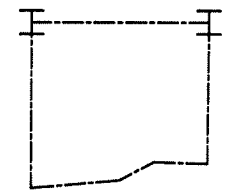


- NOTES:**
1. THIS DRAWING INCLUDES COMPONENTS OF THE FACILITY THAT ARE EXEMPT FROM PERMITTING UNDER VARIOUS PROVISIONS OF RCRA. DATA RELATED TO THESE COMPONENTS IS PROVIDED FOR INFORMATIONAL PURPOSES AND EASE OF REVIEW ONLY, AND THEY ARE NOT INTENDED TO BECOME REGULATED COMPONENTS OF THE HAZARDOUS WASTE FACILITY.
 2. FOR ACTUAL ELEVATIONS ADD 327 FEET TO THE ELEVATIONS SHOWN.

NO	DWN	CK'D	APP	REVISIONS	DATE
CBE CHAVOND-BARRY ENGINEERING CORP. 400 Route 518 • P.O. Box 205 • Blawenburg, New Jersey 08504					
SIEMENS WATER TECHNOLOGIES CORP. 2523 MUTAHAR STREET, PARKER, AZ 85344 CARBON REGENERATION SYSTEM					
ELEVATION LOOKING NORTH					
DRAWN		CHECKED		APPROVED	
DATE		DATE		DATE	
CPG 5/12/94		KEM 5/13/94			
SCALE		DWG. NO.		REV.	
1/4"=1'-0"		1478-P-004		0	



PLAN AT T.O.G. ELEVATION 169'-2"



PLAN AT T.O.G. ELEVATION 157'-2"

NOTES:
 1. THIS DRAWING INCLUDES COMPONENTS OF THE FACILITY THAT ARE EXEMPT FROM PERMITTING UNDER VARIOUS PROVISIONS OF RCRA. DATA RELATED TO THESE COMPONENTS IS PROVIDED FOR INFORMATIONAL PURPOSES AND EASE OF REVIEW ONLY, AND THEY ARE NOT INTENDED TO BECOME REGULATED COMPONENTS OF THE HAZARDOUS WASTE FACILITY.

4'-0"

NO	DWN	CK'D	APP	REVISIONS	DATE
CBE CHAVOND-BARRY ENGINEERING CORP. 400 Route 518 • P.O. Box 205 • Blawenburg, New Jersey 08504					
SIEMENS WATER TECHNOLOGIES CORP. 2523 MUTAHAR STREET, PARKER, AZ 85344 CARBON REGENERATION SYSTEM					
PLAN VIEWS					
DRAWN		CHECKED		APPROVED	
CPG 5/12/94		KEM 5/13/94			
SCALE		DWG. NO.		REV.	
1/4"=1'-0"		1478-P-003		0	

Exhibit A - Plans

T-18 Fabrication Drawings

GENERAL INFORMATION				ADDITIONAL DESIGN CONDITIONS			
SURFACE FINISH		VESSEL EXTERIOR	VESSEL INTERIOR	-	-		
	SANDBLAST	BLAST TO CLEAN	CLEAN ONLY	RADIOGRAPHY	PER AWWA D-100		
	PRIMER	-	-	STRESS RELIEVE	NOT REQUIRED	IMPACT TESTING NOT REQUIRED	
	MILS COAT	-	-	SPECIFIC GRAVITY	-		
	TOTAL D.F.T.	-	-	SEISMIC ZONE	-	IMPORTANCE FACTOR	-
	PAINT	-	-	INSPECTED BY: MODERN CUSTOM FABRICATION			
	MILS COAT	-	-	SHOP TEST	FILL WITH WATER		
	TOTAL D.F.T.	-	-				
COLOR	-	-					
MISCELLANEOUS	ESTIMATED EMPTY WEIGHT	12,700 lbs.	APPROX. CAP.	6,400 GAL.			
	EST. WT. FULL OF WATER	66,082 lbs.					
	INSULATION	NONE					
	REFERENCE DRAWINGS	-					
	CUSTOMER STANDARDS	-					
	SHIPPING FOOTPRINT	(LxWxH) 17'-6", 12'-6", 12'-6"					
DESIGN CODE	PER BH TANK DWG. P-060-P4 REV.3	HOLD POINTS	1.	-			
	-		2.	-			
	-		3.	-			
	-		4.	-			
	-		5.	-			

NAT'L BD. NO.

CERTIFIED BY

Modern Custom Fabrication, Inc.

modern

FRESNO, CA

MAWP

ATMOS.

 PSI AT

AMBT.

 °F

MAEWP

-

 PSI AT

-

 °F

MDMT

AMBT.

 °F AT

ATMOS.

 PSI

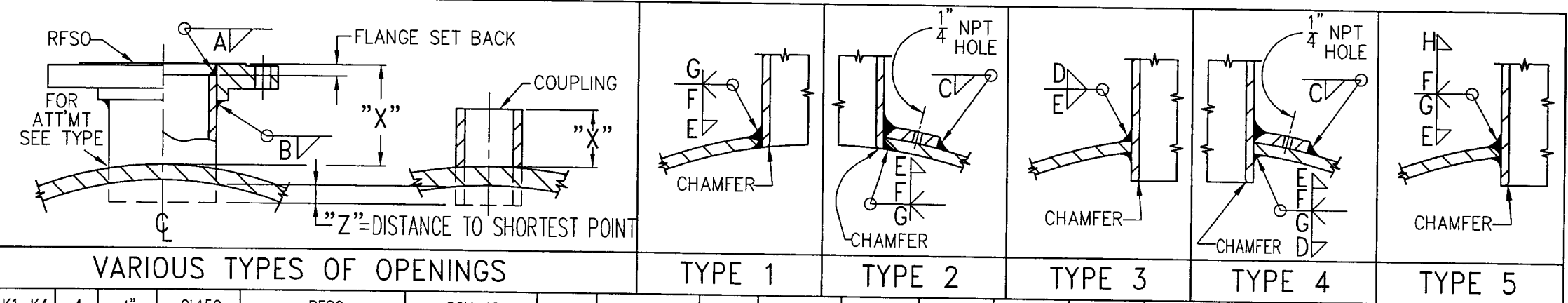
MFG'S S/N

1601794

 YEAR

2006

"X"=DISTANCE FROM CENTERLINE OF NOZZLE TO FACE OF FLANGE OR END OF COUPLING OR PIPE.



WELD PROCEDURES	
A	1.05
B	2.03
C	3.06
D	4.03
E	5.03
F	-
-	-

K1-K4	4	4	CL150	RFSO	SCH 40			1	YES	SEE DWG	SEE DWG					3/16		1/8"			SWIRL NOZZLES	
J	1	3"	CL150	RFSO	SCH 40			1	NO	SEE DWG	SEE DWG					3/16		1/8"			DRAIN	
I	1	1"	CL 3000	FULL COUPLING	SA105			1	YES	BAL	0"					3/16"		1/8"			LEAK TEST	
H	1	1"	CL 3000	HALF COUPLING	SA105			1	NO	BAL	0"					3/16"		1/8"			LEAK TEST	
G	1	1 1/2"	CL3000	HALF COUPLING	SCH 40			1	YES	BAL	0"		1/8"			3/16"		1/8"			LEVEL PROBE	
F	1	1"	CL3000	HALF COUPLING	SCH 40			1	YES	BAL	0"		1/8"			3/16"		1/8"				
E	1	6"	CL150	RFSO	SCH 40			1	YES	SEE DWG.	0"	1/4"	1/4"			1/4"		3/16"		1/4"	OUTLET	
D	1	8"	PLATE	1/4"	SCH 10			1	NO	6"	0"	3/16"	3/16"			3/16"		1/8"		3/16	WEIR INSPECTION PORT	
C1-C2	2	4"	CL150	RFSO	SCH 40			3	NO	6"	6"	1/4"	1/4"			1/4"		1/8"		1/4"	FILL	
B1-B2	2	4"	CL150	RFSO	SCH 40			1	NO	6"	0"	1/4"	1/4"			1/4"		1/8"		1/4"	VENT/SPARE W/BLIND	
A	1	20"x20"	HINGED LID	SQUARE MANWAY	1/4" PLATE			1	NO	6"	0"					3/16		1/8"			ACCESS	
NOZZLE MARK	QUANT. REQ'D.	SIZE	SERIES	DESCRIPTION	DESCRIPTION	THK.	REPAD WIDTH	TYPE	COPED TO INTERIOR	DIM "X"	DIM "Z"	WELD A	WELD B	WELD C	WELD D	WELD E	WELD F	WELD G	WELD H	FLANGE SET BACK	NOZZLE SERVICE	
FLANGE OR COUPLING				NOZZLE NECK		REINF. PAD		ATTACHMENTS														

SHOP NOTES

1. COVER ALL OPENINGS BEFORE SHIPPING.

2. STRADDLE CENTER LINES OF ALL FLANGES UNLESS OTHERWISE SPECIFIED.

3. GRIND & DEBURR ALL EDGES.

NO.

REVISION

DATE

BY

NO. REQUIRED (1) ONE ITEM NO. NONE

modern custom fabrication
fresno california

P.O. Box 11925 • 2421 E. California Ave. • Fresno, California 93721
Ph: (559) 284-4741 OR 800-800-TANK • Fax: (559) 237-3413

SIEMENS WATER TREATMENT TECH. CORP.
DOUBLE WALL STAINLESS FEED TANK
FLAT TOP CONE BOTTOM 7'-6" SIDE SHELL

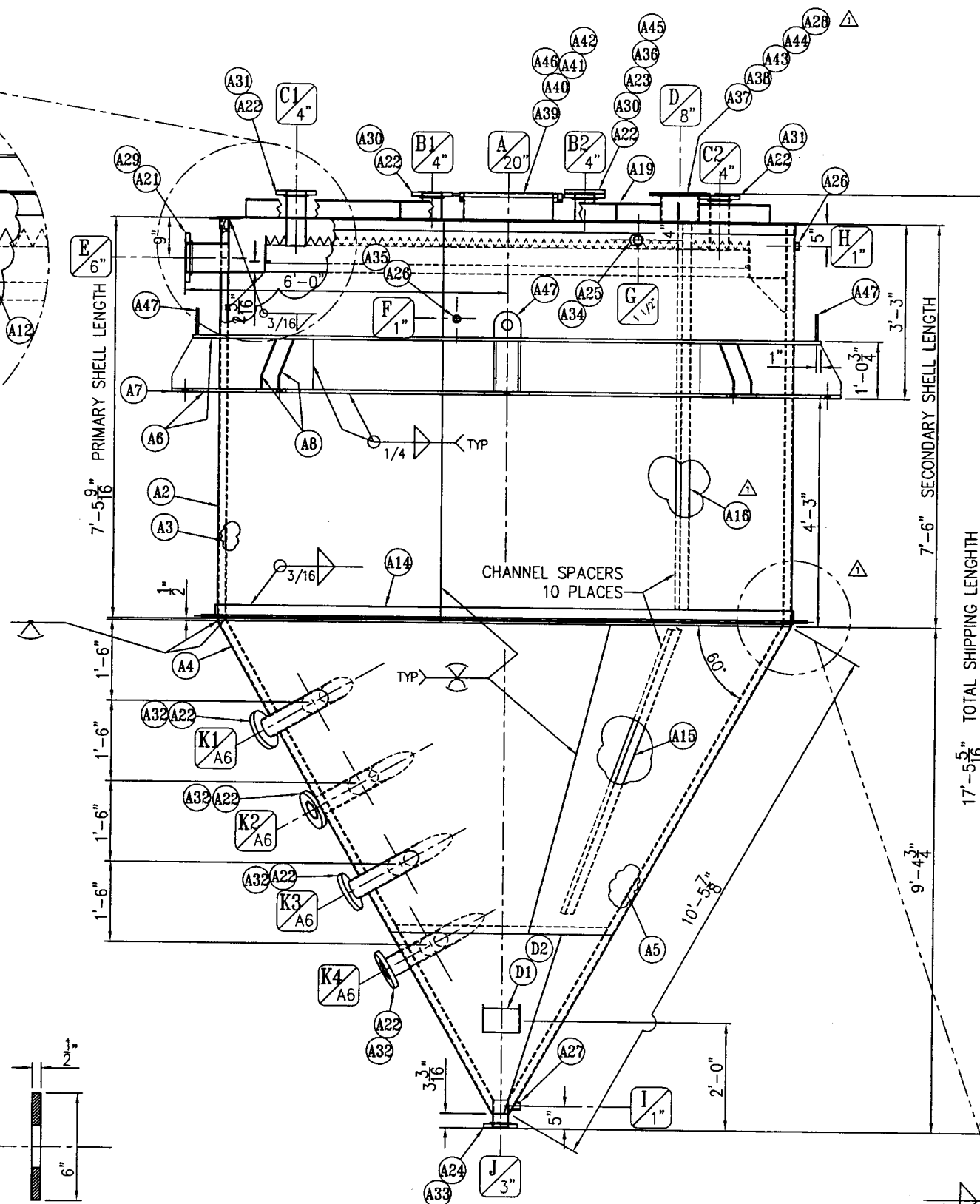
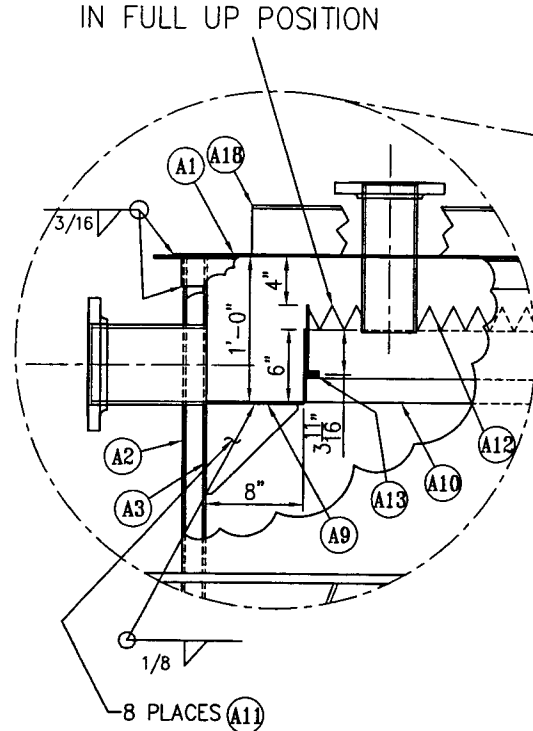
DRAWN BY: RC SCALE: NTS

CHECKED BY: DATE: 12/7/06

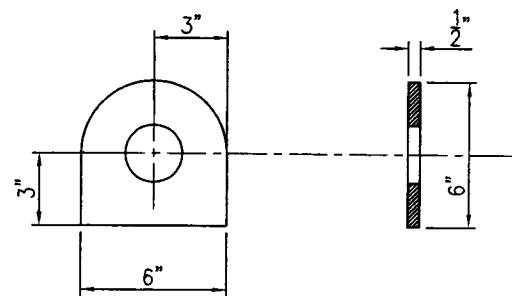
DWG/JOB NO.: 1601794

SHT. 1 of 5

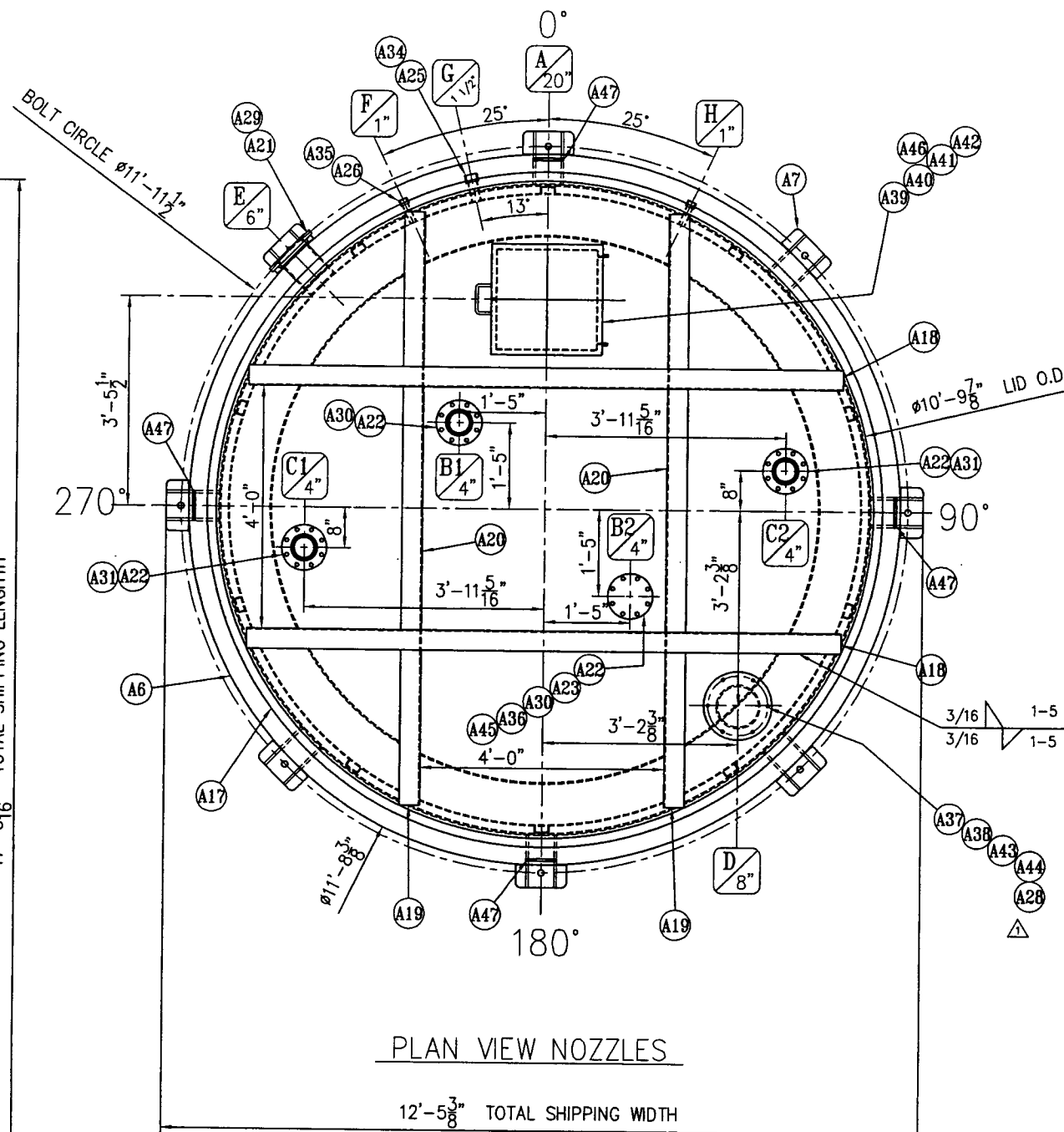
ADJUSTABLE WEIR PLATE
IN FULL UP POSITION



ELEVATION VIEW



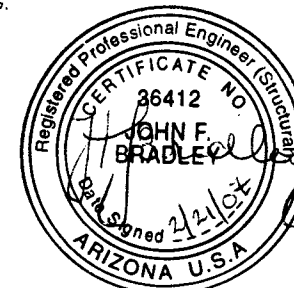
LIFT LUG



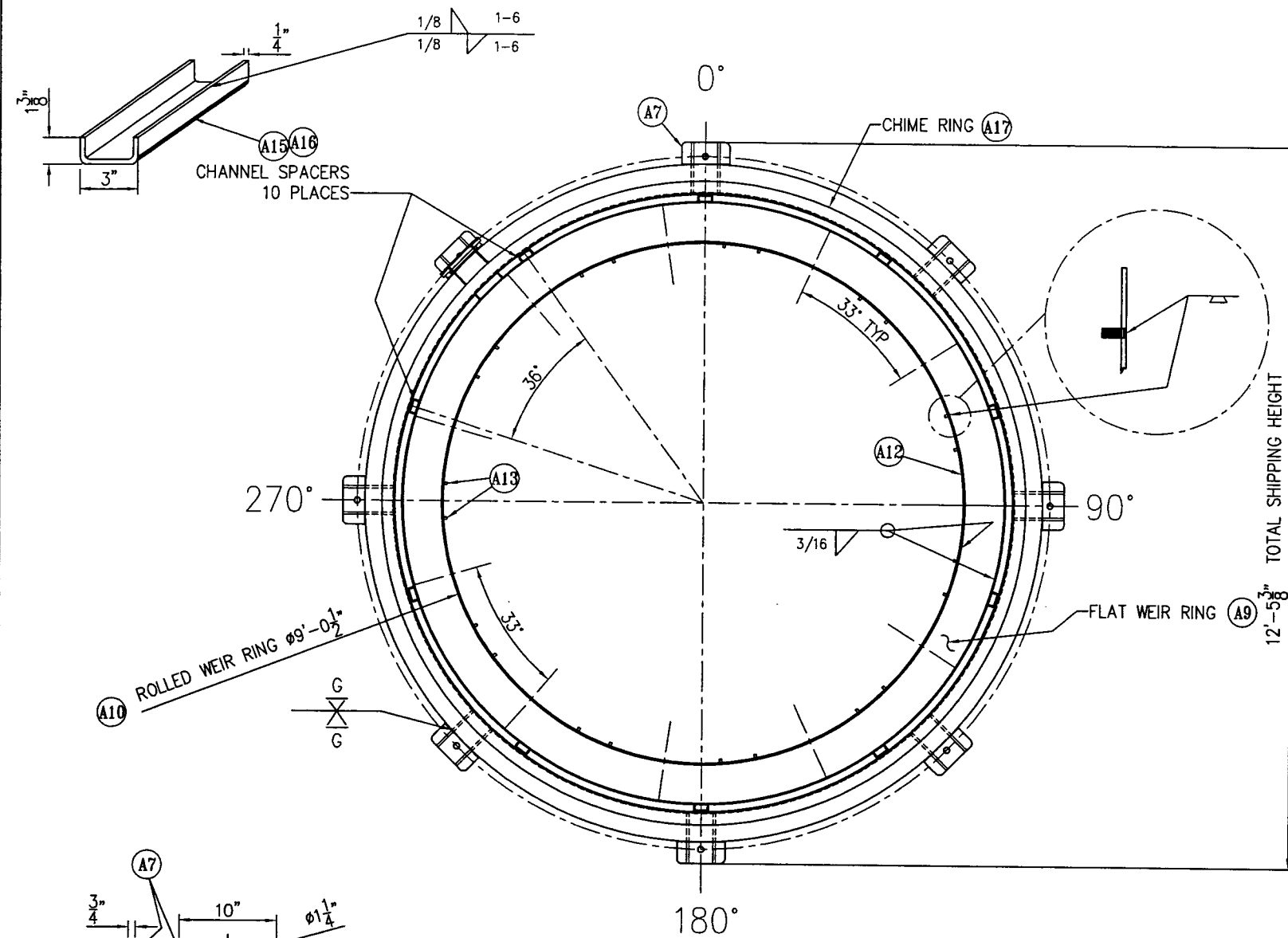
PLAN VIEW NOZZLES

12'-5 3/8" TOTAL SHIPPING WIDTH

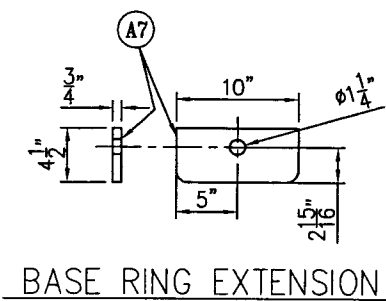
STIFFENER RING FABRICATED FROM
SEGMENTS THAT WILL BE FULL
PENETRATION WELDED TOGETHER TO FORM
THE RING.



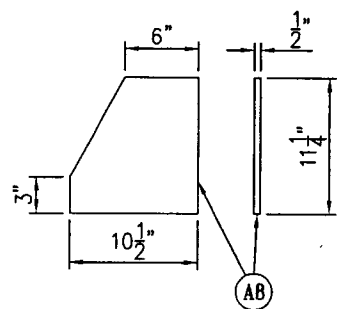
ADDED STIFFENING RING CORRECTIONS		2-9-07	TCY
NO.	REVISION	DATE	BY
modern custom fabrication fresno california			
P.O. Box 11925 • 2421 E. California Ave. • Fresno, California 93721 Ph: (559) 264-4741 OR 800-800-TANK • Fax: (559) 237-3413			
Prepared for SIEMENS WATER TREATMENT TECH. CORP.			
DOUBLE WALL STAINLESS FEED TANK FLAT TOP CONE BOTTOM 7'-6" SIDE SHELL			
DRAWN BY: RC	SCALE: NTS		
CHECKED BY:	DATE: 12/7/06		
DWG/JOB NO.: 1601794	SHT. 2 OF 5		



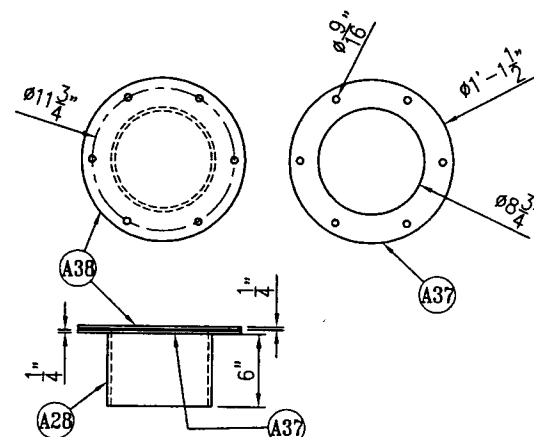
PLAN VIEW
ADJUSTABLE WEIR AND STUDS



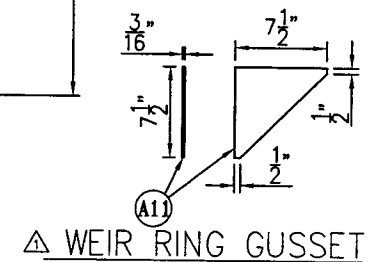
BASE RING EXTENSION



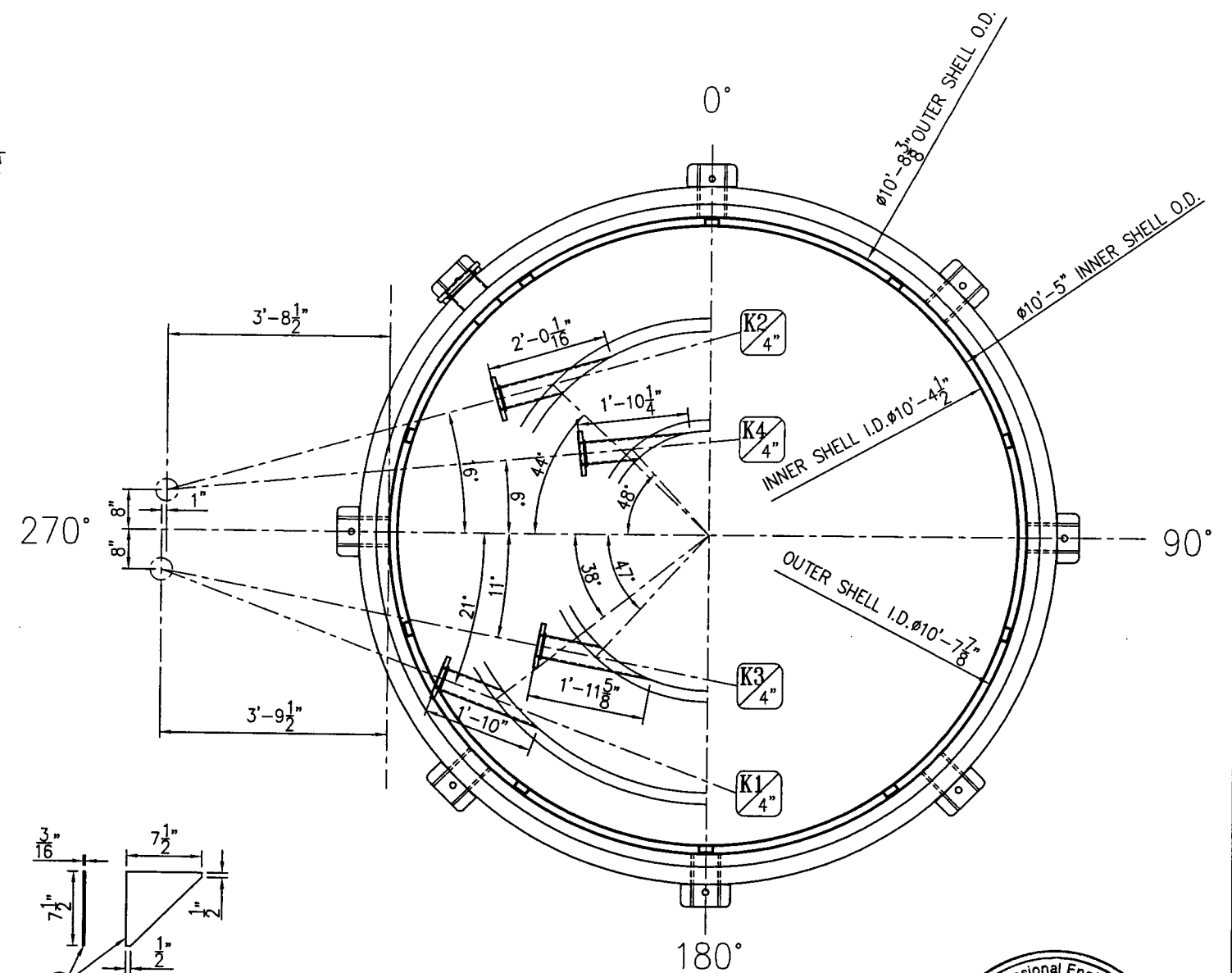
BASE RING GUSSET



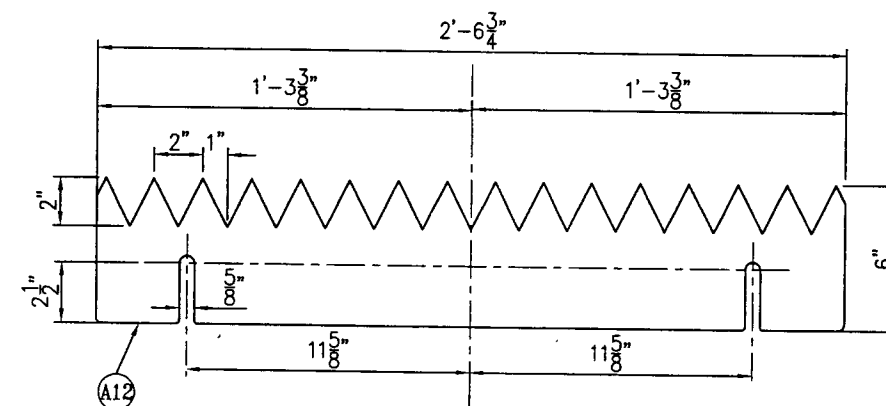
INSPECTION PORT NOZZLE



WEIR RING GUSSET



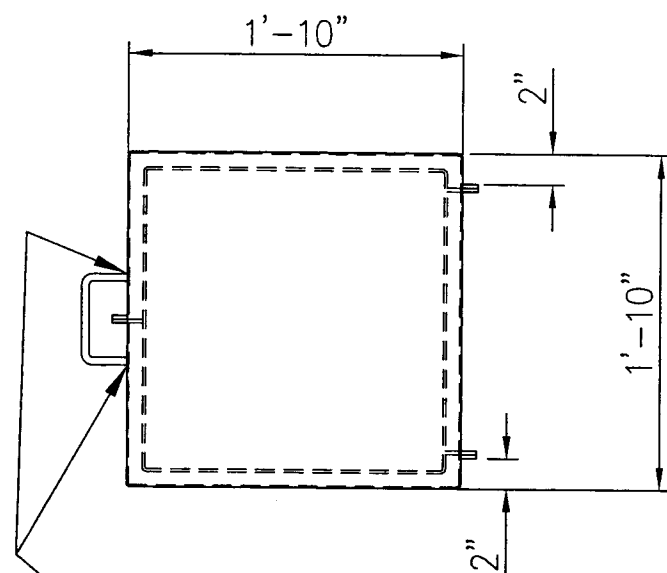
ROTATION AND ANGLE OF
NOZZLES K1-K4



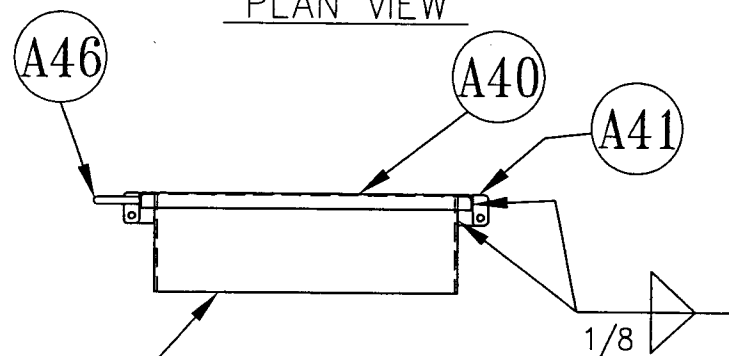
AJUSTABLE WEIR PLATE



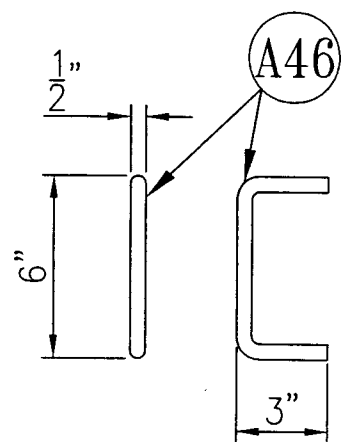
CORRECTIONS		2-9-07	TCY
NO.	REVISION	DATE	BY
modern custom fabrication fresno california P.O. Box 11925 • 2421 E. California Ave. • Fresno, California 93721 Ph: (559) 264-4741 OR 800-800-TANK • Fax: (559) 237-3413			
Prepared for SIEMENS WATER TREATMENT TECH. CORP. DOUBLE WALL STAINLESS FEED TANK FLAT TOP CONE BOTTOM 7'-6" SIDE SHELL			
DRAWN BY: RC	SCALE: NTS		
CHECKED BY:	DATE: 12/7/06		
DWG/JOB NO.: 1601794	SHT. 3 OF 5		



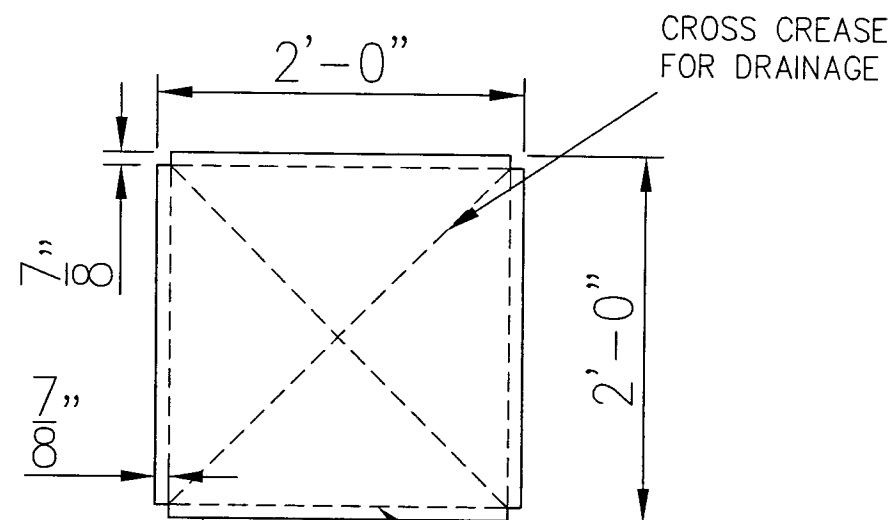
PLAN VIEW



SIDE VIEW

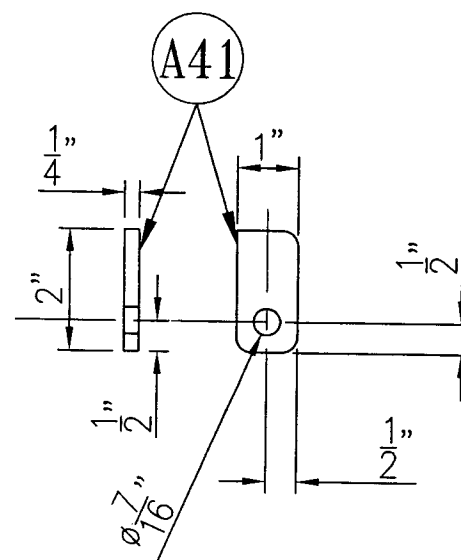


HANDLE

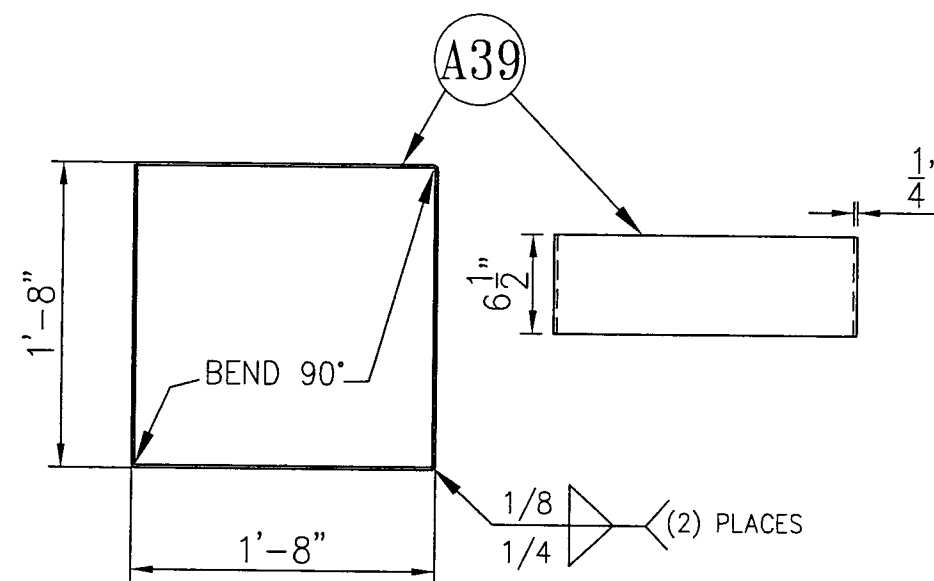


LID BLANK

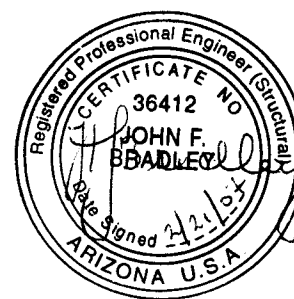
BEND UP 90°
4 PLACES





HINGE AND HASP PARTS



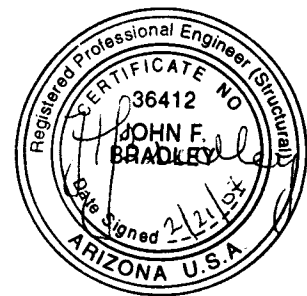
PLAN VIEW BOX



	-	-	-
NO.	REVISION	DATE	BY
modern custom fabrication fresno california			
			
P.O. Box 11925 • 2421 E. California Ave. • Fresno, California 93721 Ph: (559) 264-4741 OR 800-800-TANK • Fax: (559) 237-3413			
<u>Prepared for</u> SIEMENS WATER TREATMENT TECH. CORP. DOUBLE WALL STAINLESS FEED TANK FLAT TOP CONE BOTTOM 7'-6" SIDE SHELL			
DRAWN BY: RC		SCALE: NTS	
CHECKED BY:		DATE: 12/7/06	
DWG/JOB NO.: 1601794		SHT. 4 OF 5	

ITEM	DESCRIPTION	1601794	PART NO.	MATERIAL SPEC.	SEE DETAIL	MTR'S REQ'D	PRE- ORDERED	WEIGHT PER PIECE IN LBS	SQ. FT.	QTY	TOTAL QTY
CUSTOM BUYOUT MATERIAL											
A1	ROOF, PL 3/16" X 129 7/8" O.D.			SA240-TP304				705	92	1	1
A2	SHELL (OUTER), PL 1/4" X 90" X 33'-6 1/2"			SA240-TP304				2,568	253	1	1
A3	SHELL (INNER), PL 1/4" X 89 9/16" X 32'-7 15/16"			SA240-TP304				2,489	245	1	1
A4	CONE (OUTER), PL 1/4" X 259 1/4" O.D. X 178"			SA240-TP304				1,850	182	1	1
A5	CONE (INNER), PL 1/4" X 252 3/8" O.D. X 178"			SA240-TP304				1,754	172	1	1
A6	BASE RING, PL 3/4" X 140 3/8" O.D. X 128 3/8" I.D.			SA240-TP304				539	37	2	2
A7	BASE RING EXTENSION, PL 3/4" X 4 1/2" X 0'-10"			SA240-TP304				10	.5	8	8
A8	BASE RING GUSSET, PL 1/2" X 10 1/2" X 0'-11 1/4"			SA240-TP304				16	1	16	16
A9	WEIR RING (FLAT), PL 3/16" X 124 1/2" O.D. X 108 1/2" I.D.			SA240-TP304				156	21	1	1
A10	WEIR RING (ROLLED), PL 3/16" X 6" X 28'-4 1/2"			SA240-TP304				108	29	1	1
A11	WEIR RING GUSSET, PL 3/16" X 7 1/2" X 0'-7 1/2"			SA240-TP304				3	1	8	8
A12	ADJUSTABLE WEIR PLATE, PL 3/16" X 6" X 2'-6 3/4"			SA240-TP304				10	2	11	11
A13	WEIR PLATE STUDS, 1/2" X NC X 0'-1"			304 SS						22	22
A14	PERIMETER BAND, PL 1/2" X 3" X 23'-8 7/8"			SA240-TP304				280	6	1	1
A15	CHANNEL SPACER, PL 1/4" X 4 3/4" X 5'-9" (CONE)			SA240-TP304				24	2	10	10
A16	CHANNEL SPACER, PL 1/4" X 4 3/4" X 7'-2" (SHELL)			SA240-TP304				29	2	10	10
A17	CHIME RING, L 2 1/2" X 2 1/2" X 3/16" X 34'-3 1/8"			SA479-TP304				120		1	1
A18	ROOF STIFFENER, L 4" X 4" X 1/4" X 9'-9 1/4"			SA479-TP304				66		2	2
A19	ROOF STIFFENER, L 4" X 4" X 1/4" X 2'-10 1/4"			SA479-TP304				12		4	4
A20	ROOF STIFFENER, L 4" X 4" X 1/4" X 4'-0"			SA479-TP304				25		2	2
A21	FLANGE, 6" X CL150 X RFSO (E)			SA182-TP304				19		1	1
A22	FLANGE, 4" X CL150 X RFSO (B1,B2,C1,C2,K1-K4)			SA182-TP304				13		8	8
A23	BLIND FLANGE, 4" X CL150 X RF (B2)			SA182-TP304				17		1	1
A24	FLANGE, 3" X CL150 X RFSO			SA182-TP304				8		1	1
A25	HALF COUPLING, 1 1/2" X CL3000			SA182-TP304				1		1	1
A26	HALF COUPLING, 1" X CL3000			SA182-TP304				1		2	2
A27	FULL COUPLING, 1" X CL3000			SA182-TP304				1		1	1
A28	PIPE, 8" X SCH 10 X 0'-6 1/4" (D) △			SA312-TP304				7		1	1
A29	PIPE, 6" X SCH 40 X 0'-9 1/4" (E)			SA312-TP304				10		1	1
A30	PIPE, 4" X SCH 40 X 0'-6" (B1,B2)			SA312-TP304				6		2	2
A31	PIPE, 4" X SCH 40 X 1'-0" (C1,C2)			SA312-TP304				11		2	2
A32	PIPE, 4" X SCH 40 X 2'-0" (K1-K4)			SA312-TP304				11		4	4
A33	PIPE, 3" X SCH 40 X 0'-6 1/4" (J)			SA312-TP304				4		1	1
A34	PIPE, 1 1/2" X SCH 40 X 0'-4" (G)			SA312-TP304				1		1	1
A35	PIPE, 1" X SCH 40 X 0'-4" (F,H)			SA312-TP304				1		2	2
A36	HEX BOLTS, 5/8" X NC X 3 1/2" W/ NUTS (B2)	A193-B8-TP304	A194-B8-TP304					3		8	8
A37	PLATE FLANGE, PL 1/4" X 13 1/2" O.D. X 8 3/4" I.D. (D)			SA240-TP304				4	1	1	1
A38	PLATE BLIND FLANGE, PL 1/4" X 13 1/2" O.D. (D)			SA240-TP304				11	1	1	1

ITEM	DESCRIPTION	PART NO.	MATERIAL SPEC.	SEE DETAIL	MTR'S REQ'D	PRE- ORDERED	WEIGHT PER PIECE IN LBS	SQ. FT.	QTY	TOTAL QTY
STOCK SHELF MATERIAL										
A39	MANWAY BOX, PL 1/4" X 6 1/2" X 6'8" (A)		SA240-TP304				36	4	1	1
A40	MANWAY LID, PL 14 GA. X 24" X 2'-0"		SA240-TP304				12	4	1	1
A41	HINGE & HASP PARTS, PL 1/4" X 1" X 0'-2" (A)		SA240-TP304						6	6
A42	HEX BOLTS, 3/8" X NC X 1" W/LOCK NUTS (A)	A193-B8-TP304	A194-B8-TP304						2	2
A43	HEX BOLTS, 3/8" X NC X 1 1/4" W/NUTS (D)	A193-B8-TP304	A194-B8-TP304						6	6
A44	GASKET, TO FIT 8" PLATE FLANGE (D)		NEOPRENE						1	1
A45	GASKET, TO FIT 4" CL150 (B2)		NEOPRENE						1	1
A46	MANWAY HANDLE, BAR 1/2" Ø X 0'-11"		SA479-TP304				1		1	1
A47	LIFT LUG, PL 1/2" X 6" X 0'-6"	△	SA240-TP304				5		4	4
A48	STIFFENEING RING, PL 1/2" X 129 3/8" I.D. X 135 3/8" O.D.	△	SA240-TP304				177		1	1
TOTAL WEIGHT										
							2,700 LBS			



△ ADDED STIFFENING RING CORRECTIONS		2-9-07	TCY
NO.	REVISION	DATE	BY
NO. REQUIRED (1) ONE		ITEM NO. NONE	
modern custom fabrication fresno california			
P.O. Box 11925 • 2421 E. California Ave. • Fresno, California 93721 Ph: (559) 264-4741 OR 800-800-TANK • Fax: (559) 237-3413			
Prepared for			
SIEMENS WATER TREATMENT TECH. CORP. DOUBLE WALL STAINLESS FEED TANK FLAT TOP CONE BOTTOM 7'-6" SIDE SHELL			
DRAWN BY: RC		SCALE: NTS	
CHECKED BY:		DATE: 12/7/06	
DWG./JOB NO.: 1601794		SHT. 5 of 5	

Exhibit A - Plans

T-18 Support Steel Drawings

10

7

4

1

11

8

5

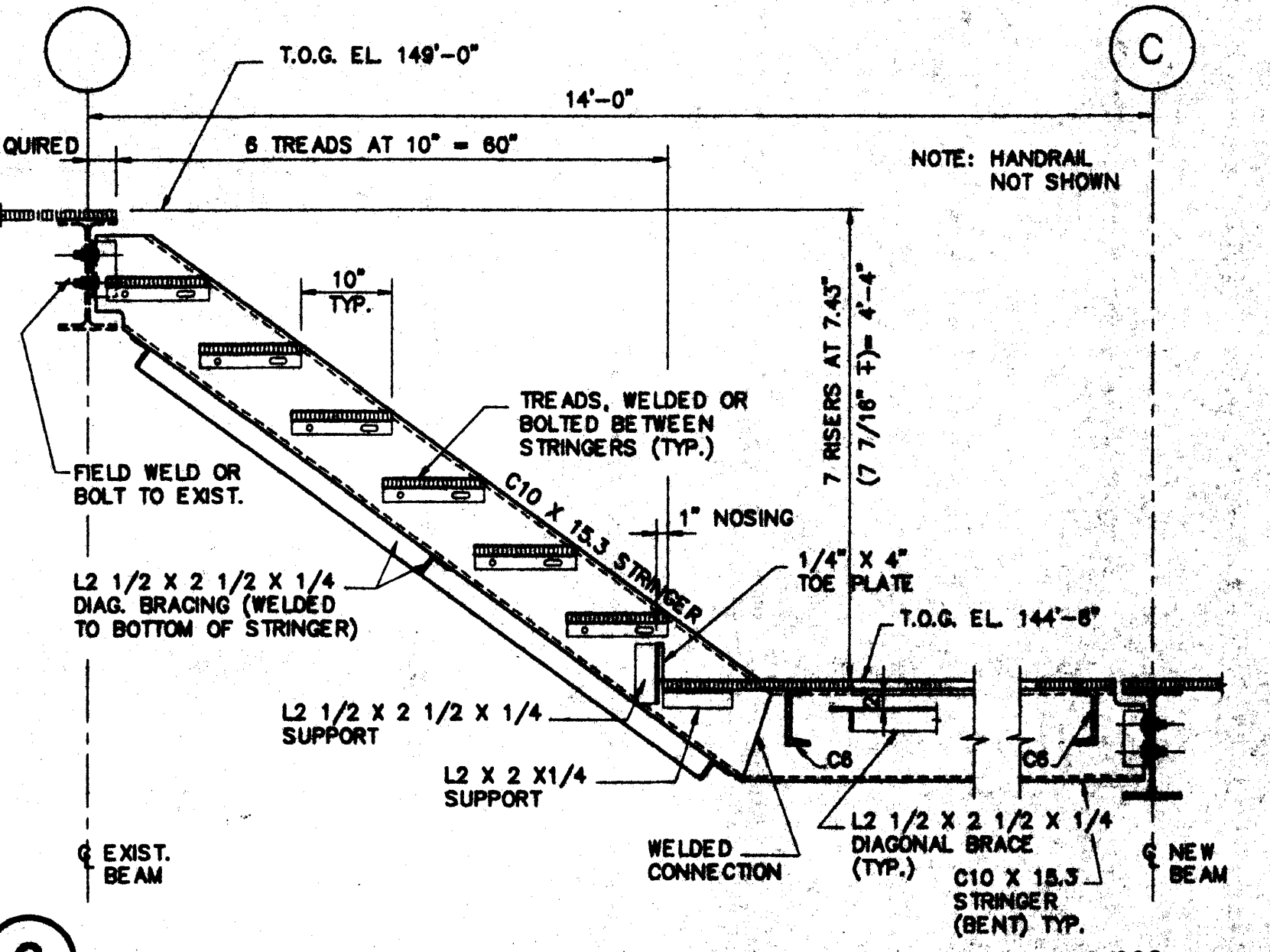
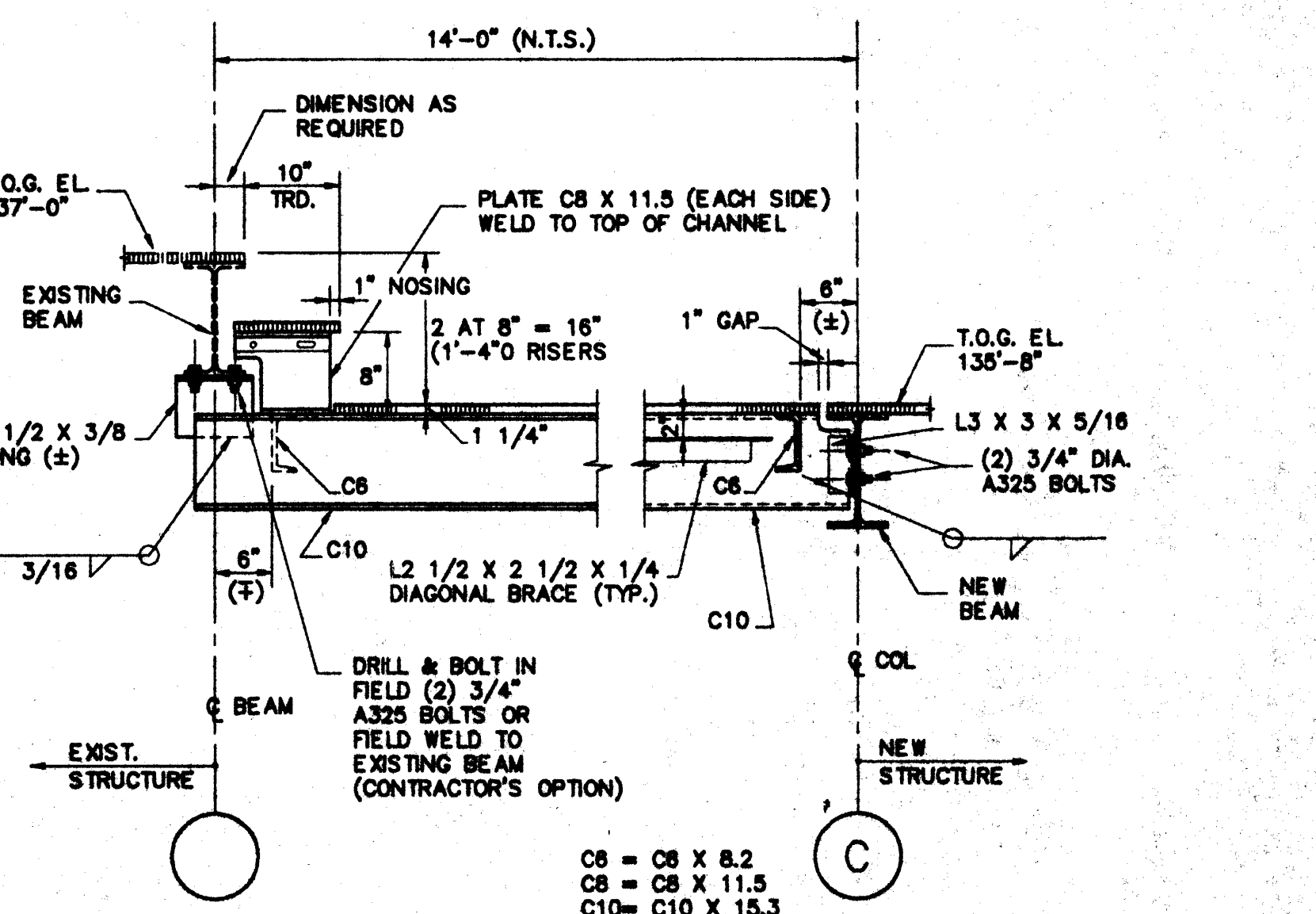
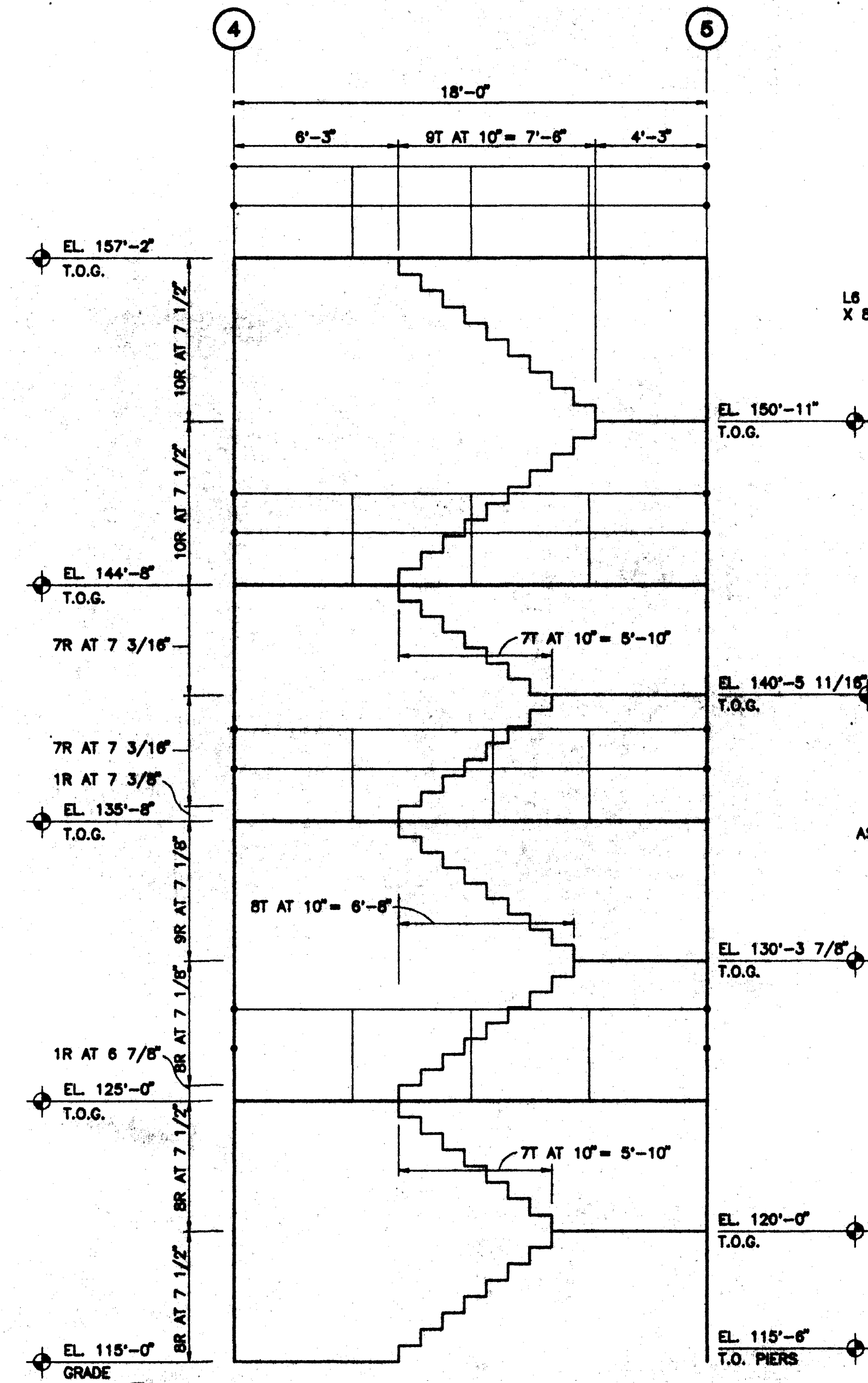
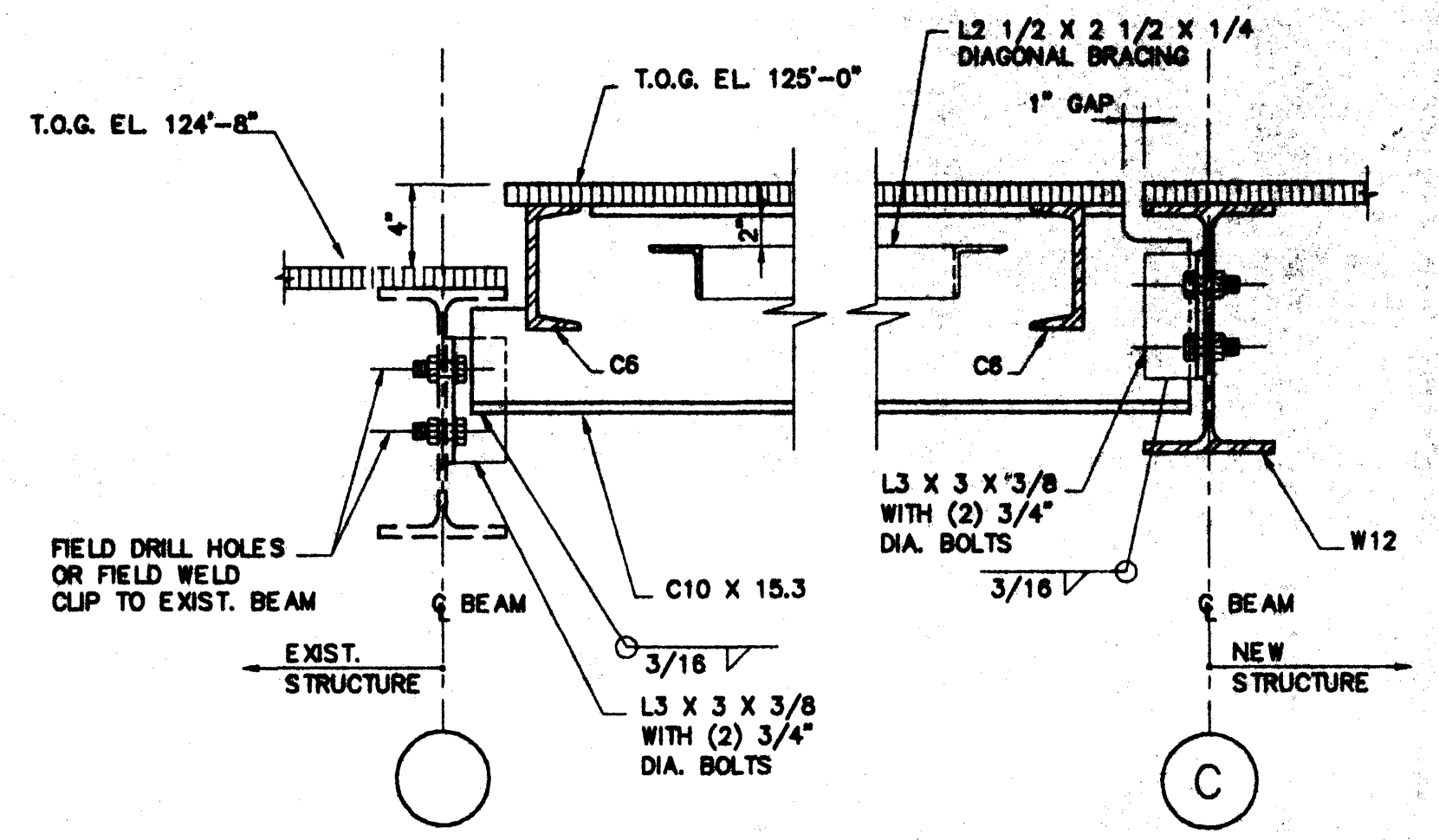
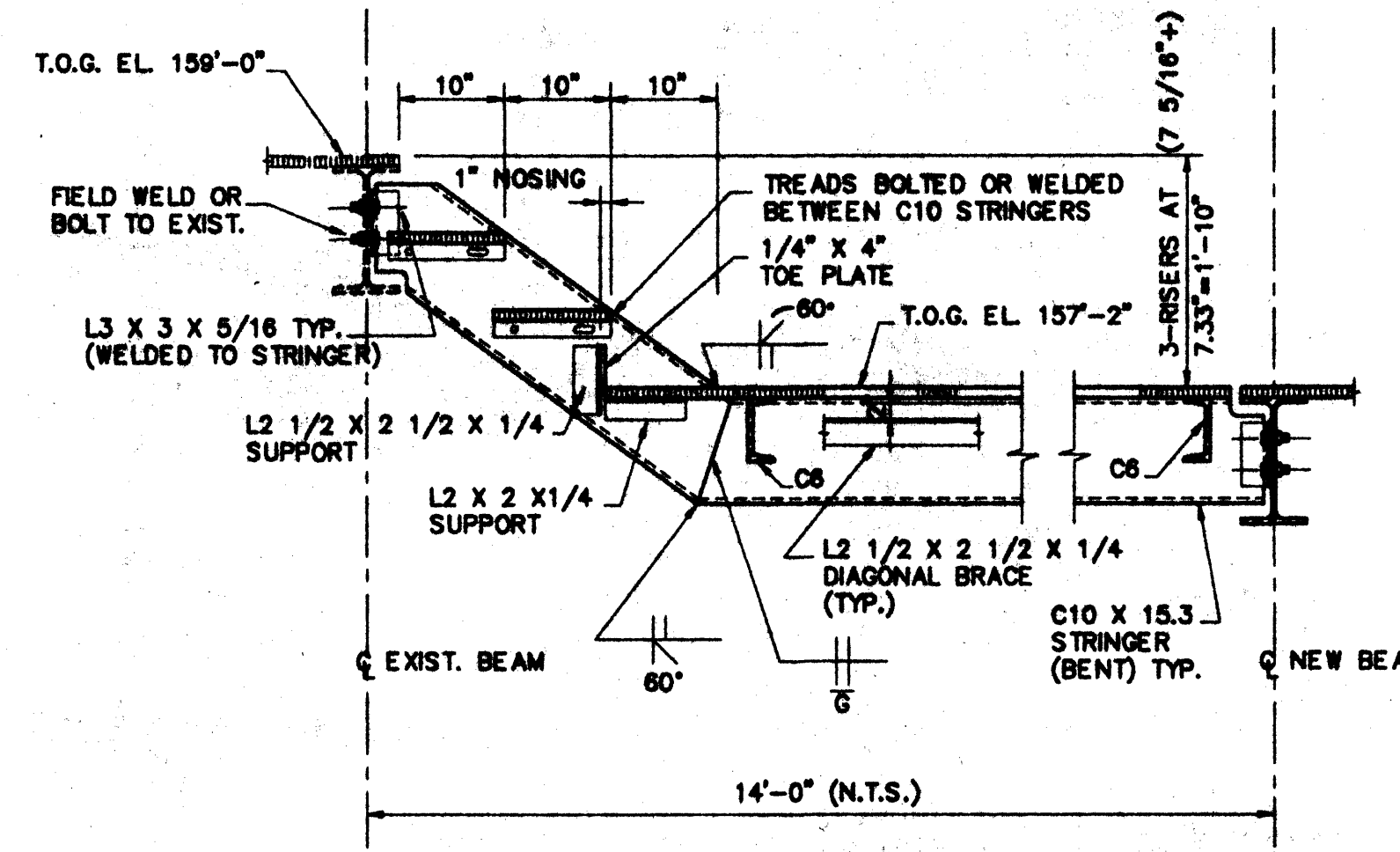
2

12

9

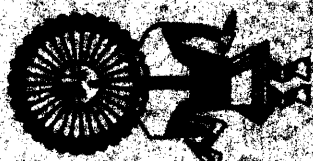
6

3



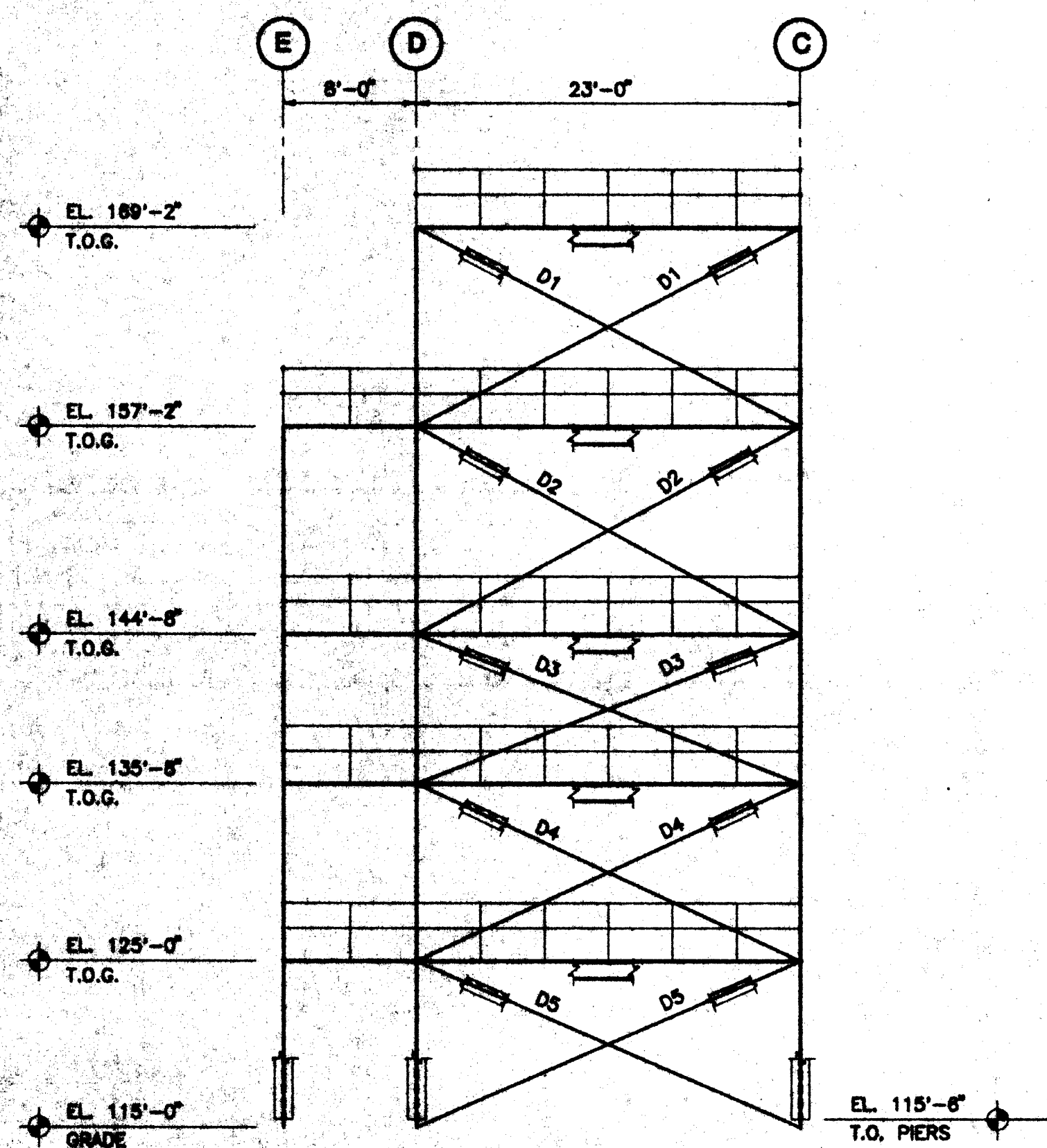
REVISIONS

A.V. SCHWAN & ASSOC., INC.
CONSULTING ENGINEERS
7000 E. CAMELBACK RD. STE. 280
SCOTTSDALE, ARIZONA 85251
(602) 995-4331 (FAX)

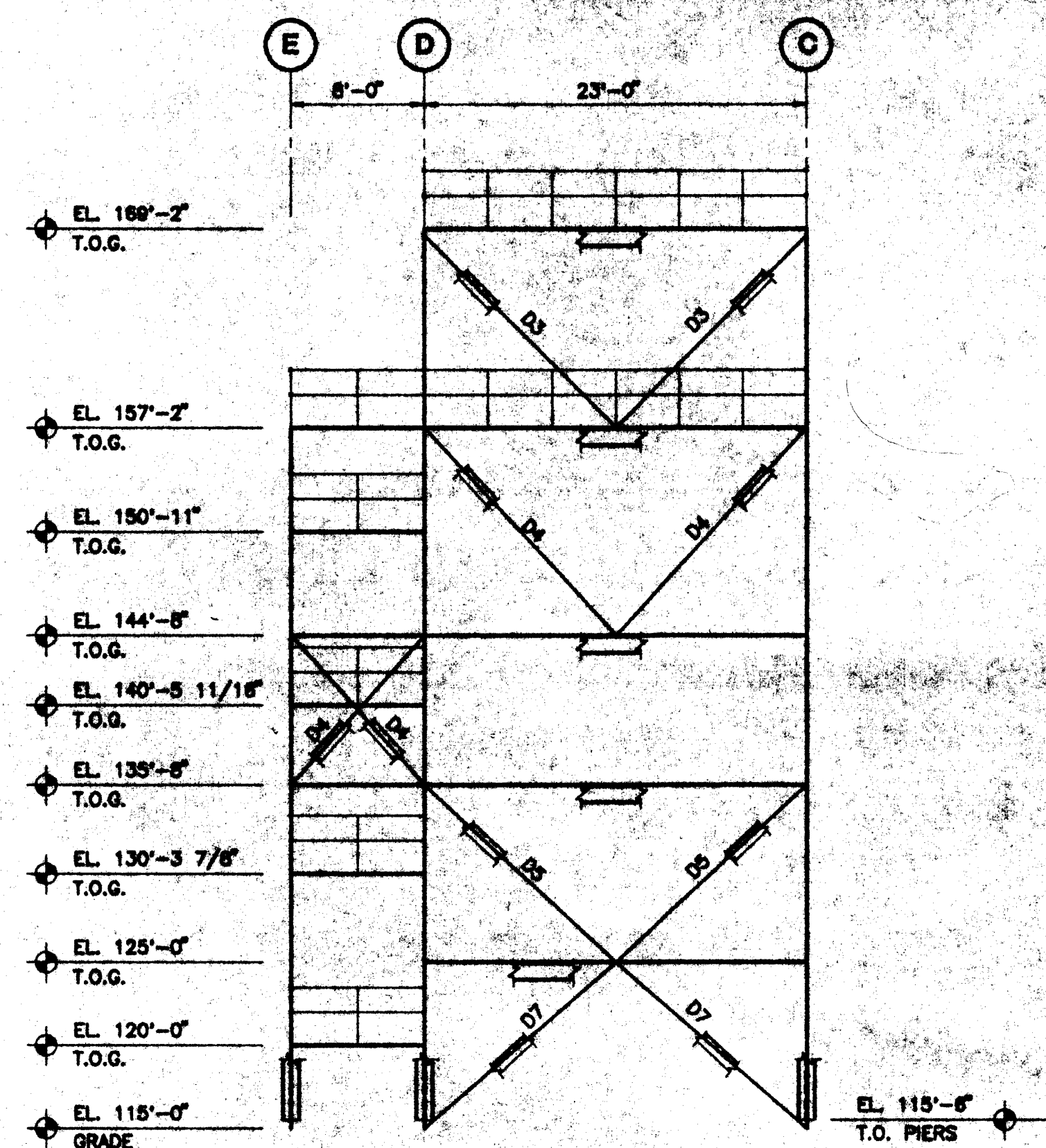


WING-NICHOLS CARBON REACTION FURNACE
STAIR/BRIDGE DETAILS
REV. NO. 0000
DATE: 2/9/96
APPROVED: AVE
DESIGNED: CHV/BRY
DRAWN: CHV/BRY

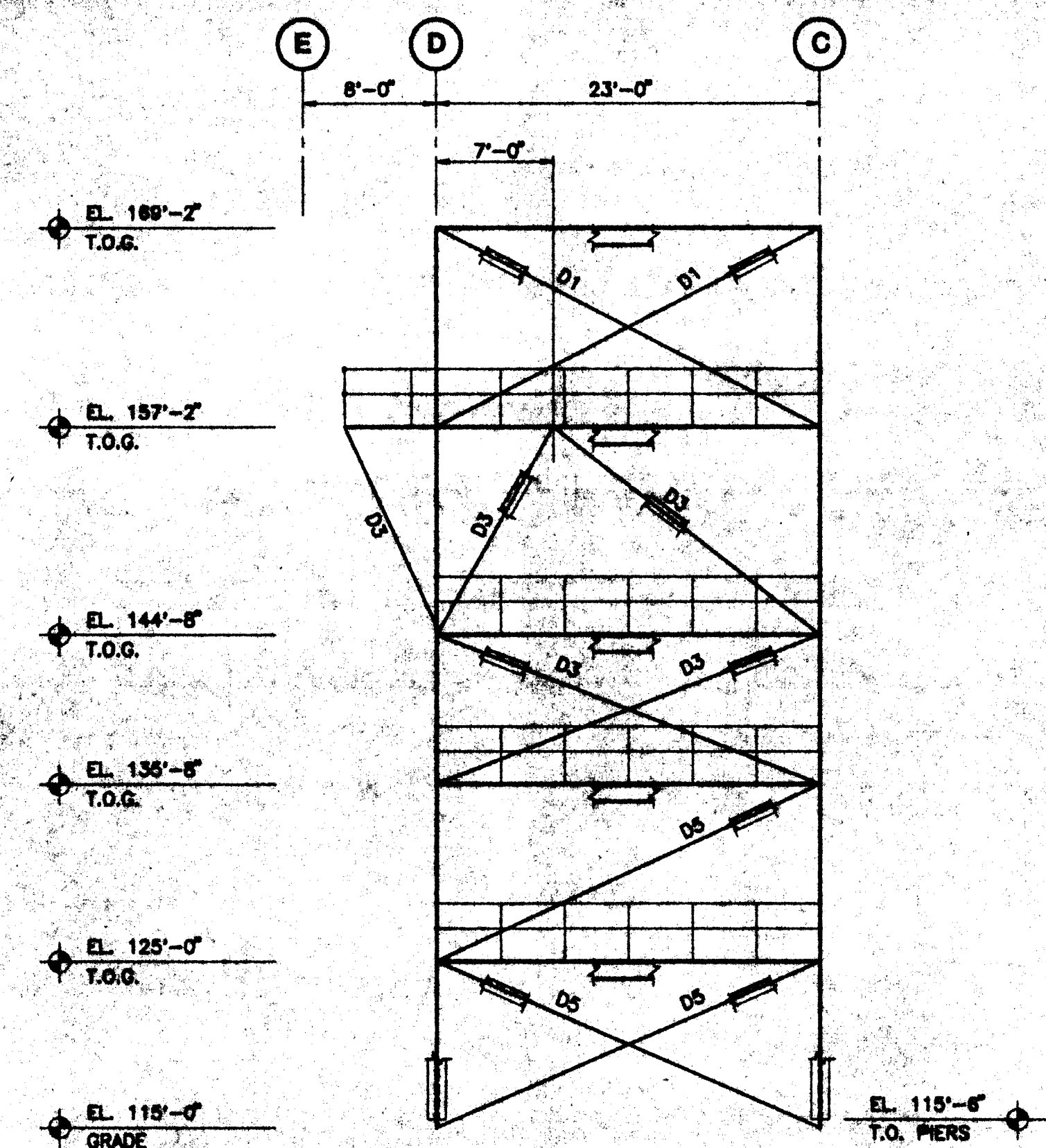
DATE: 2/9/96
APPROVED: AVE
DESIGNED: CHV/BRY
DRAWN: CHV/BRY
FEB 9 1996
FEB 9 1996
CHAVOND-BARRY
S6



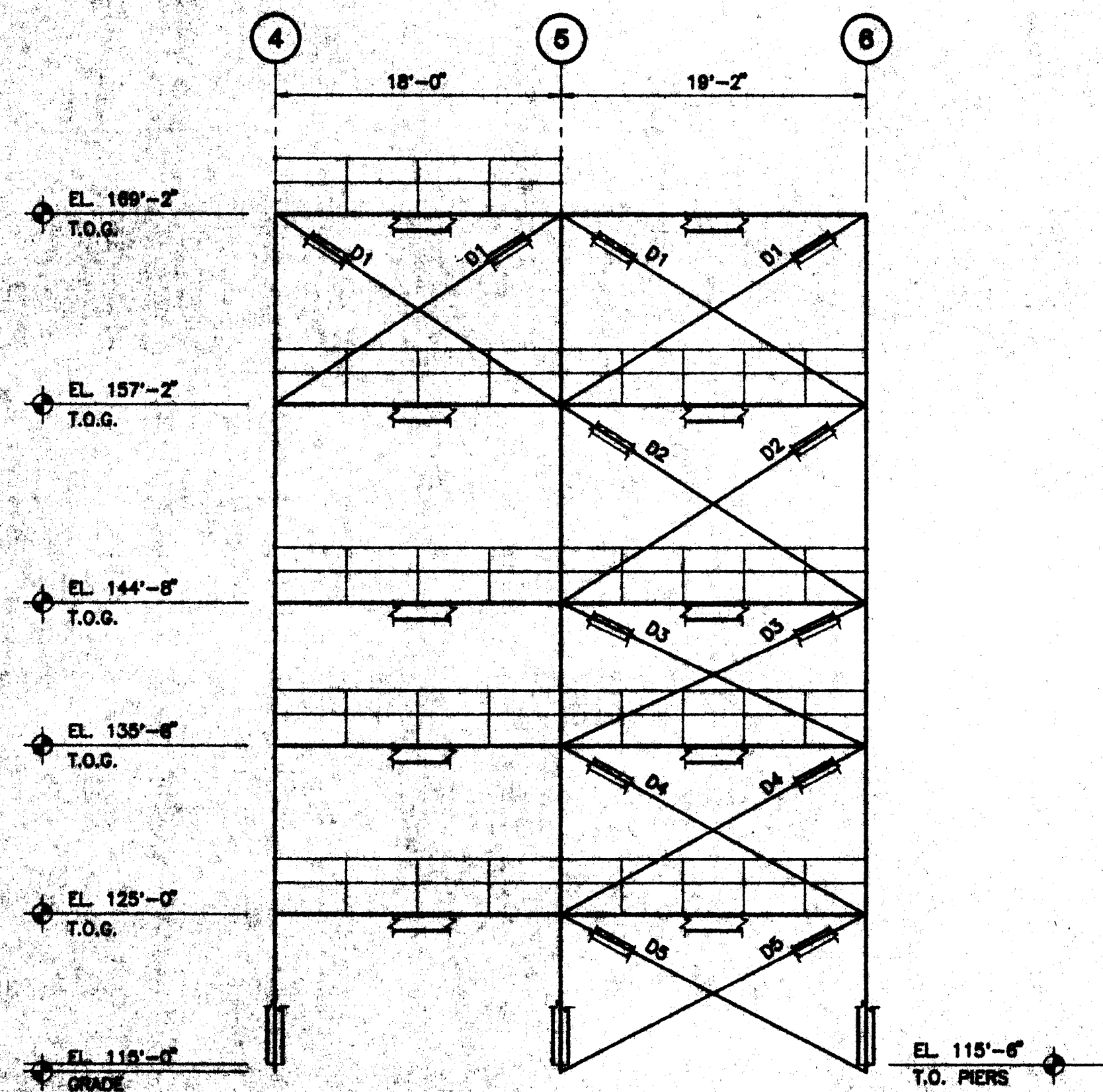
ELEV. ALONG GRID ④
(LOOKING EAST) 1/8"=1'-0"



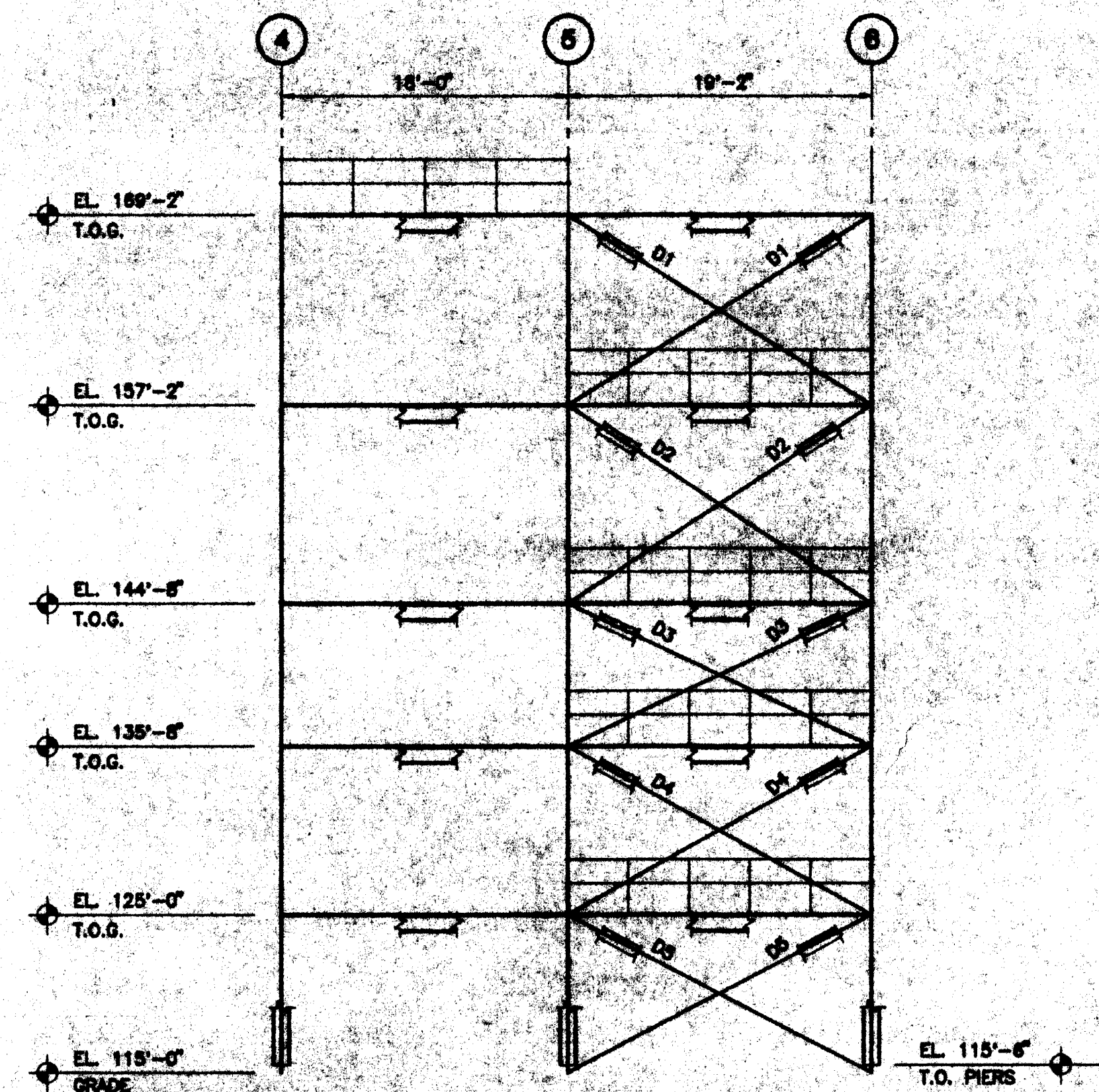
ELEV. ALONG GRID ⑤
(LOOKING EAST) 1/8"=1'-0"



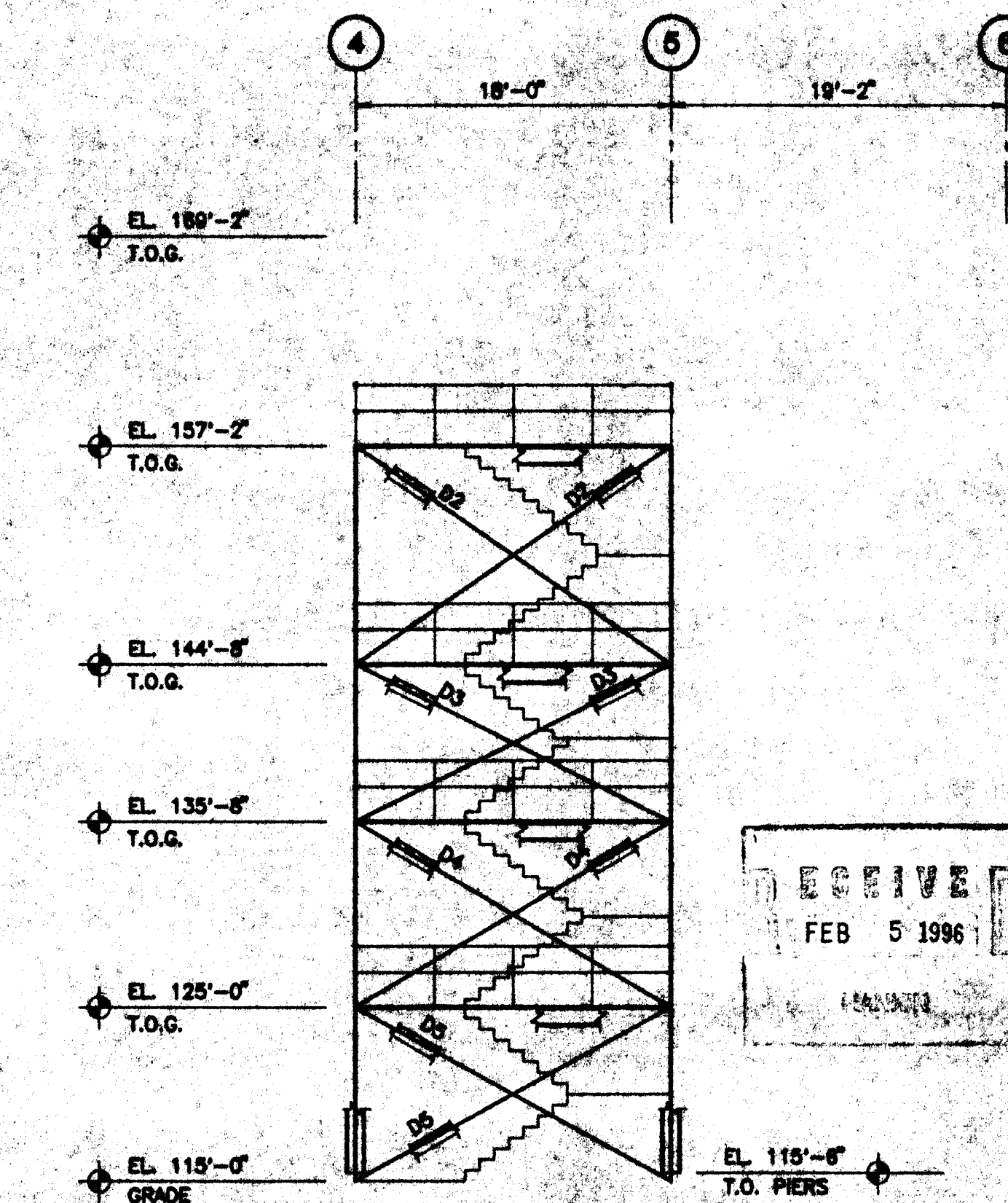
ELEV. ALONG GRID ⑥
(LOOKING EAST) 1/8"=1'-0"



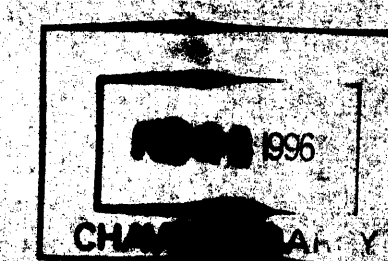
ELEV. ALONG GRID ③
(LOOKING NORTH) 1/8"=1'-0"



ELEV. ALONG GRID ④
(LOOKING NORTH) 1/8"=1'-0"



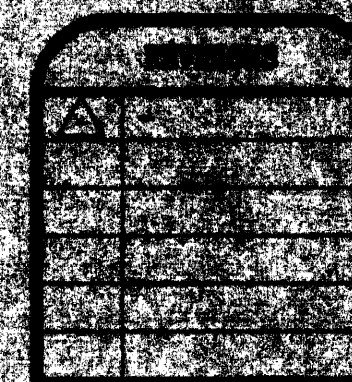
ELEV. ALONG GRID ⑤
(LOOKING NORTH) 1/8"=1'-0"



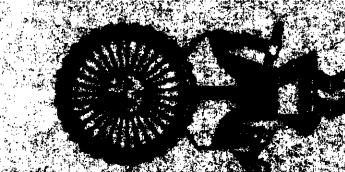
ISSUED
ENGINEERING DEPT.
FEB 5 1996
HANKIN ENVIRONMENTAL
SYSTEMS INC.

BRACE SCHEDULE	
MARK	SIZE
D1	(2) L3 3/2 X 2 3/2 X 1/4
D2	(2) L3 1/2 X 3 X 1/4
D3	(2) L4 X 3 X 1/4
D4	(2) L4 X 3 1/2 X 1/4
D5	(2) L5 X 3 1/2 X 5/16
D6	NOT USED
D7	(2) L4 X 3 1/2 X 5/8

SCHEMATIC
NOT FOR CONSTRUCTION USE

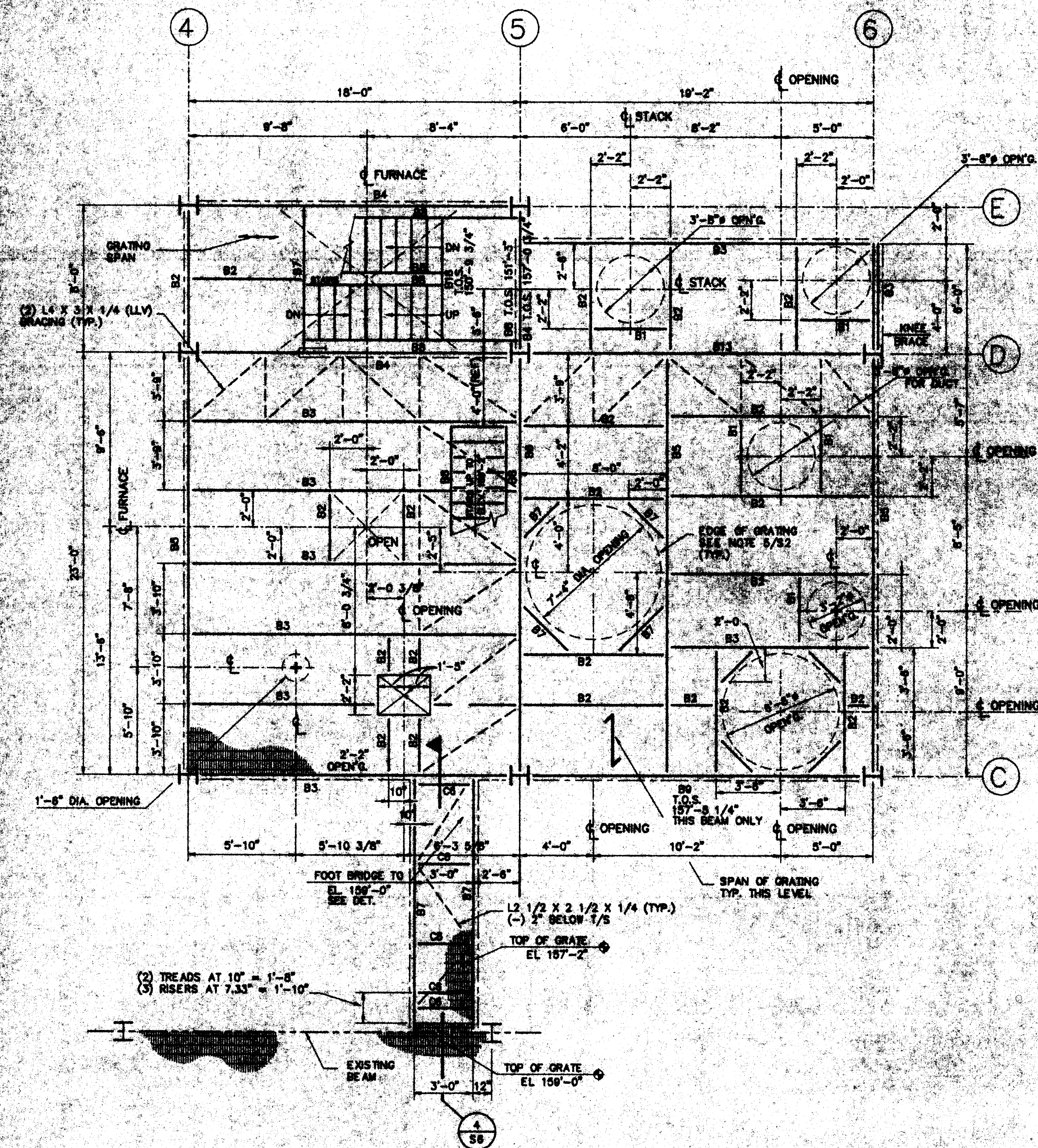


AVSCHAN & ASSOC. INC.
CONSULTING ENGINEERS
700 E. CAMPBELL RD. STE. 1228
SUNNYVALE, CALIF. 95351
(408) 265-1331 FAX (408) 265-7403



HANKIN ENVIRONMENTAL
SYSTEMS INC.
1000 W. 14TH AVE. SUITE 100
DENVER, CO 80202
(303) 733-1111

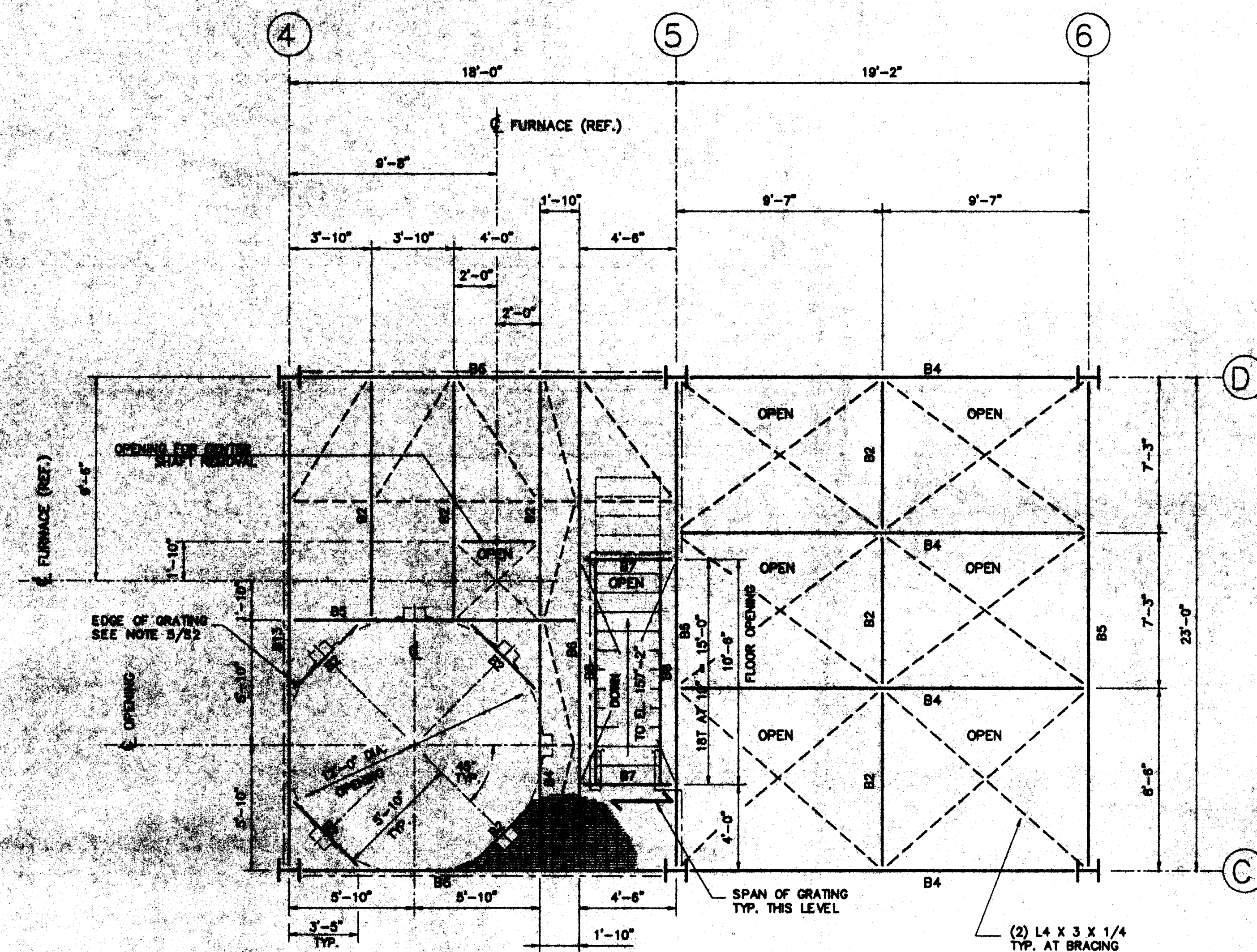
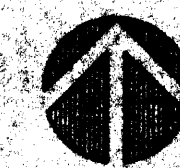
S5



FRAMING PLAN AT T.O.G. EL 157'-2"

T.O.S. AT -1 1/4" U.N.O.

1/4" = 1'-0"



FRAMING PLAN AT T.O.G. EL 169'-2"

T.O.S. AT -1 1/4" U.N.O.

1/4" = 1'-0"

BEAM SCHEDULE		BEAM SCHEDULE	
MARK	SIZE	MARK	SIZE
B1	W8 X 10	B10	NOT USED
B2	W10 X 12	B11	W12 X 26
B3	W12 X 14	B12	W12 X 35
B4	W14 X 22	B13	W21 X 44
B5	W16 X 26	B14	W24 X 68
B6	W18 X 35	B15	W24 X 78
B7	C10 X 15.3	B16	NOT USED
B8	MC12 X 10.6	B17	C8 X 10.5
B9	W16 X 40	B18	C8 X 11.5



FEB - 5 1996

ISSUED
ENGINEERING DEPT.

FEB 5 1996

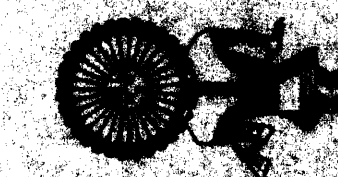
HANKIN ENVIRONMENTAL
SYSTEMS INC.

RECEIVED
FEB 5 1996

HANKIN

REVISIONS

A.V. SCHWAN & ASSOC., INC.
CONSULTING ENGINEERS
7000 E. CAMELBACK RD. STE. 220
SCOTTSDALE, ARIZONA 86261
(602) 265-4531 970-0463 (FAX)

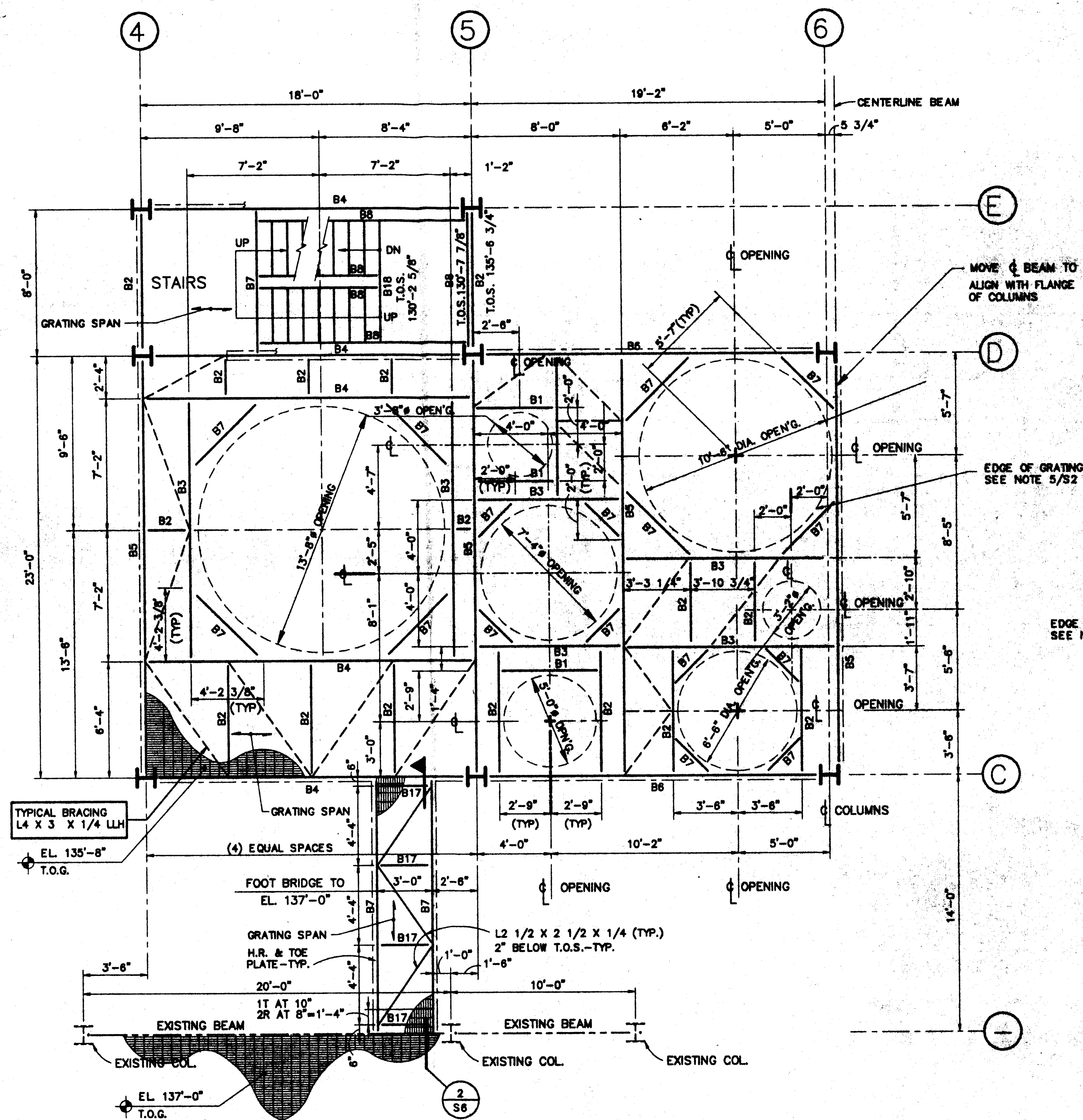


HANKIN-NICHOLS CARBON REACTIVATION FURNACE
STEEL FRAMING PLANS
AT EL 157'-2" & 169'-2"
FOR
HANKIN ENVIRONMENTAL SYSTEMS, INC.

JOB NO.: 9960
DRAWN: DMW
DESIGNED: FOS
APPROVED: AVS
DATE: 2/2/96

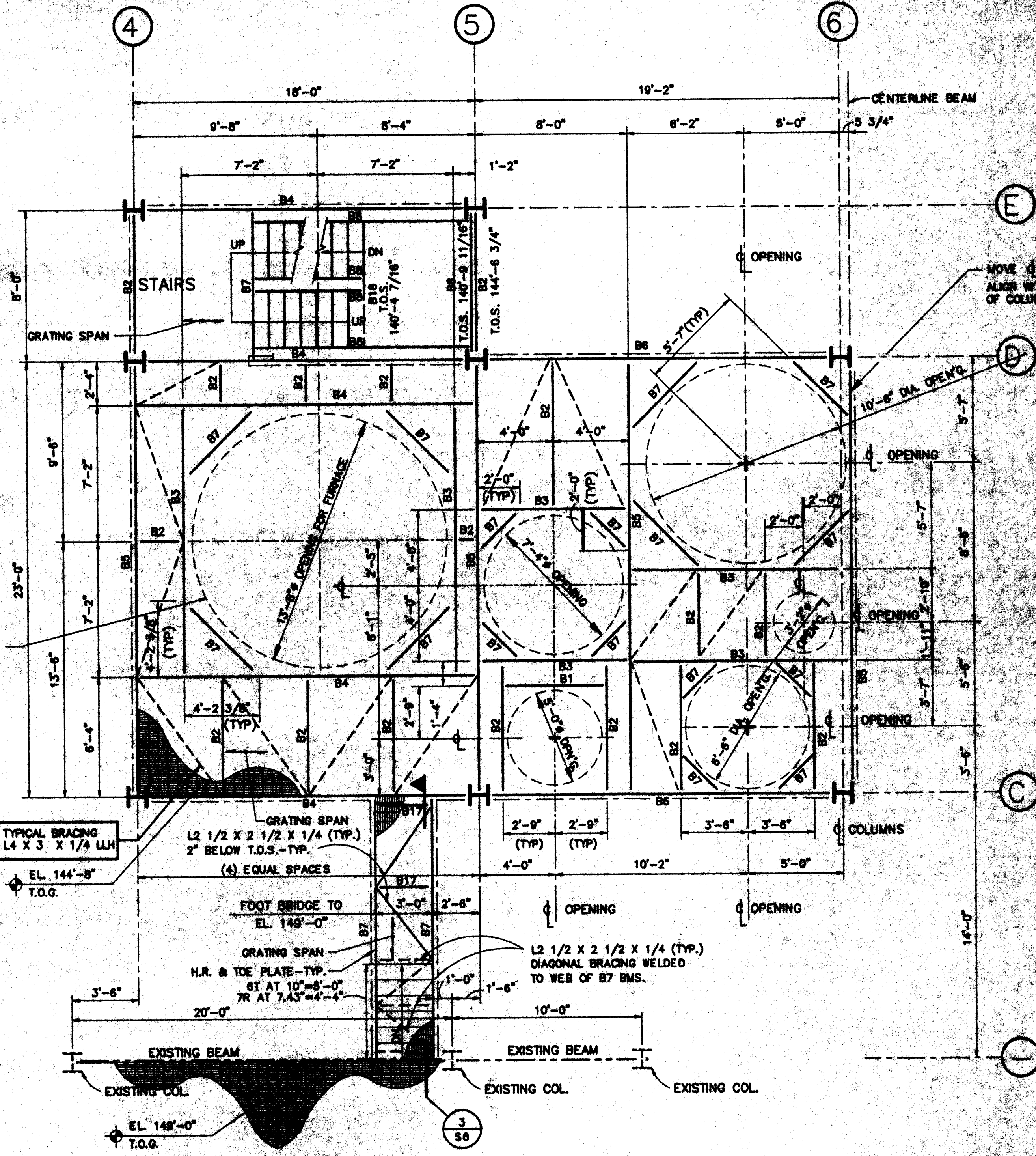
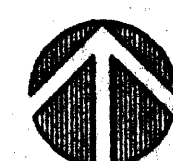
SHEET TITLE:
FRAMING
PLANS

SHEET NUMBER:
34



FRAMING PLAN AT T.O.G. EL 135'-8"

T.O.S. AT -1 1/4" U.N.O.



FRAMING PLAN AT T.O.G. EL 144'-8"

T.O.S. AT -1 1/4" U.N.O.



BEAM SCHEDULE			
MARK	SIZE	MARK	SIZE
B1	W8 X 10	B10	NOT USED
B2	W10 X 12	B11	W12 X 28
B3	W12 X 14	B12	W12 X 35
B4	W14 X 22	B13	W21 X 44
B5	W16 X 26	B14	W24 X 68
B6	W18 X 35	B15	W24 X 76
B7	C10 X 15.3	B16	NOT USED
B8	MC12 X 10.6	B17	C6 X 10.5
B9	W18 X 40	B18	C6 X 11.2

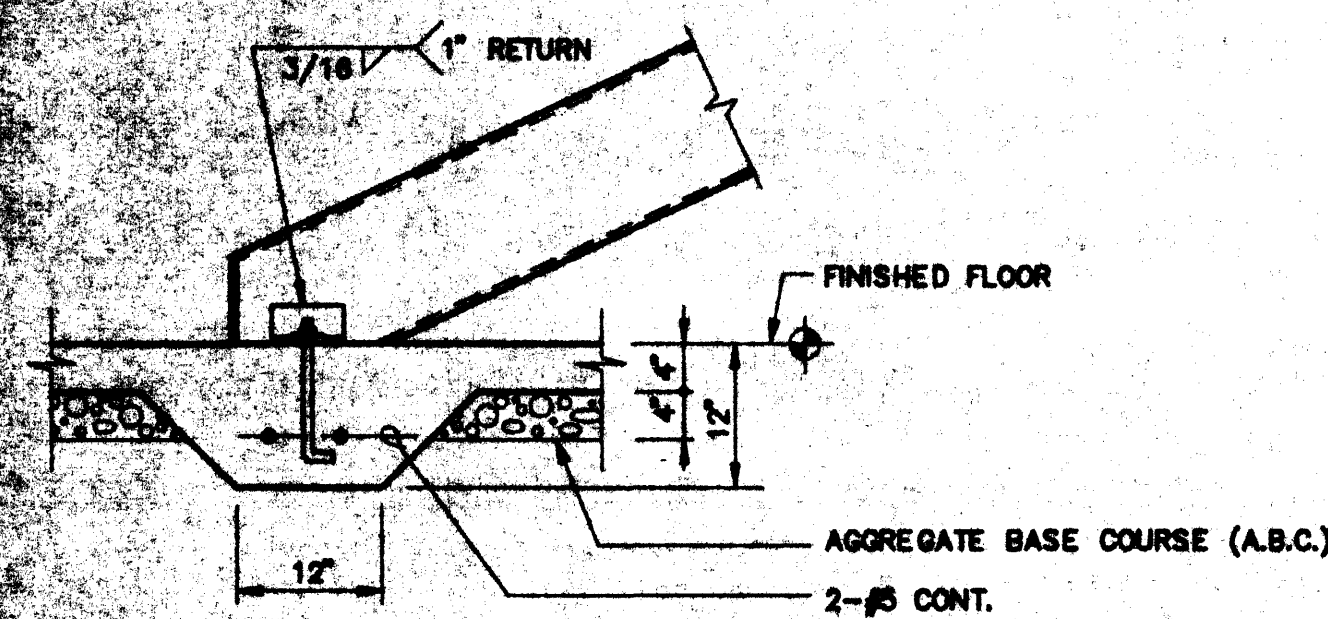
RECEIVED
FEB 6 1996
CHAVOND-BARRY

RECEIVED
FEB 6 1996
FEB - 9 1996

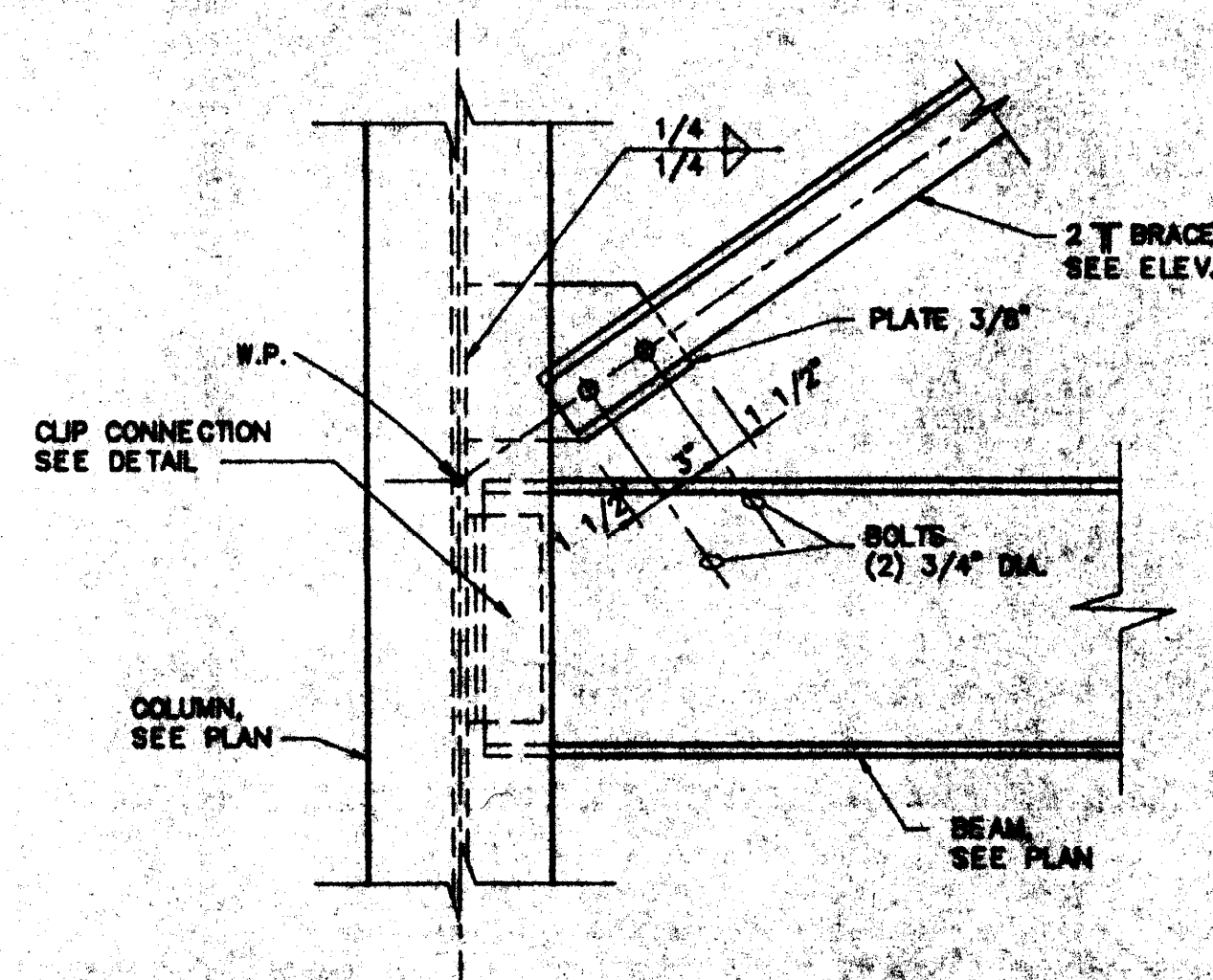
ALYSON W. B. ASSOC. INC.
STRUCTURAL ENGINEERING
1000 W. 10TH AVE. SUITE 100
DENVER, CO 80202
(303) 733-8811 FAX (303) 733-8812

ALYSON W. B. ASSOC. INC.
STRUCTURAL ENGINEERING
1000 W. 10TH AVE. SUITE 100
DENVER, CO 80202
(303) 733-8811 FAX (303) 733-8812

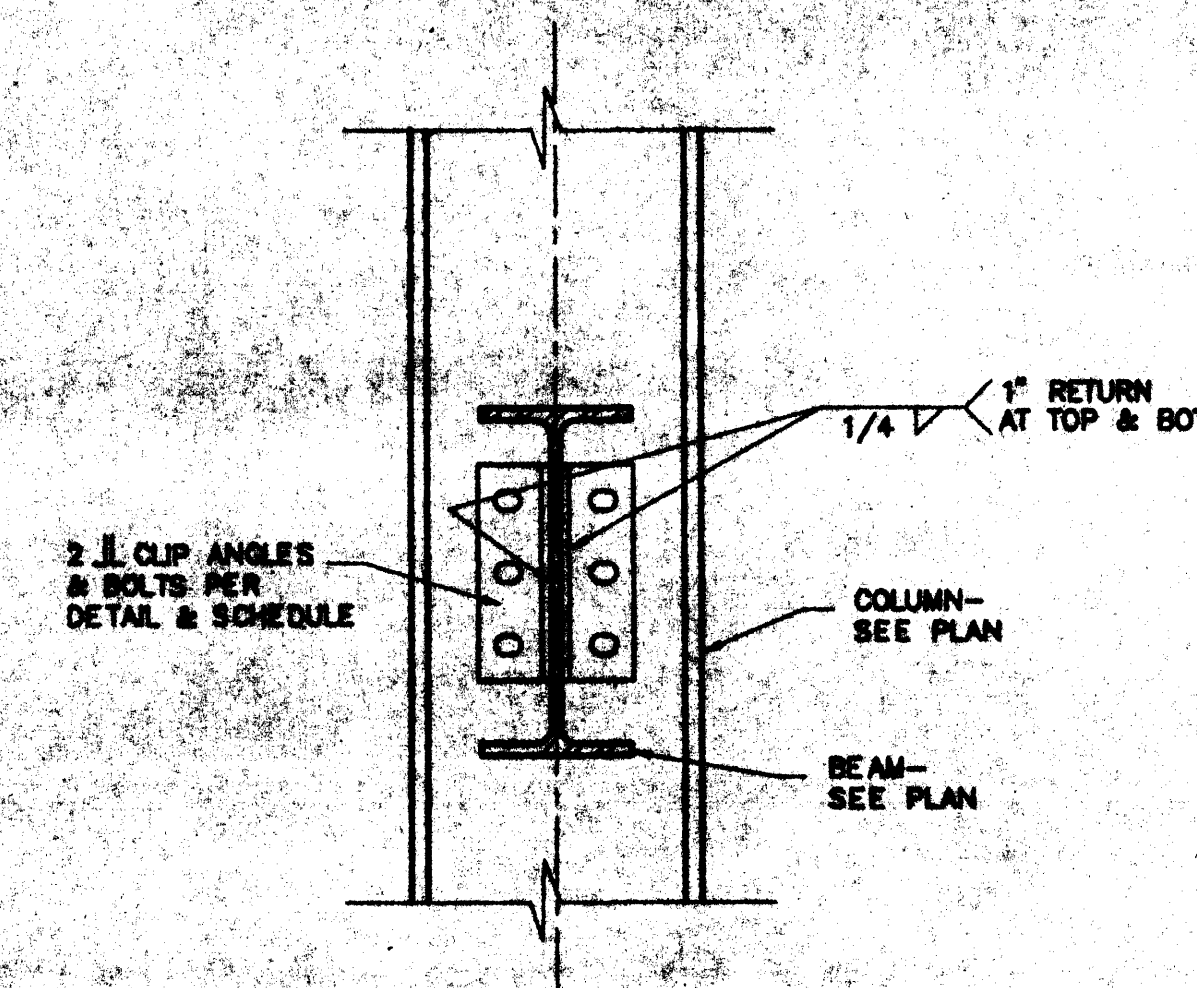
ALYSON W. B. ASSOC. INC.
STRUCTURAL ENGINEERING
1000 W. 10TH AVE. SUITE 100
DENVER, CO 80202
(303) 733-8811 FAX (303) 733-8812



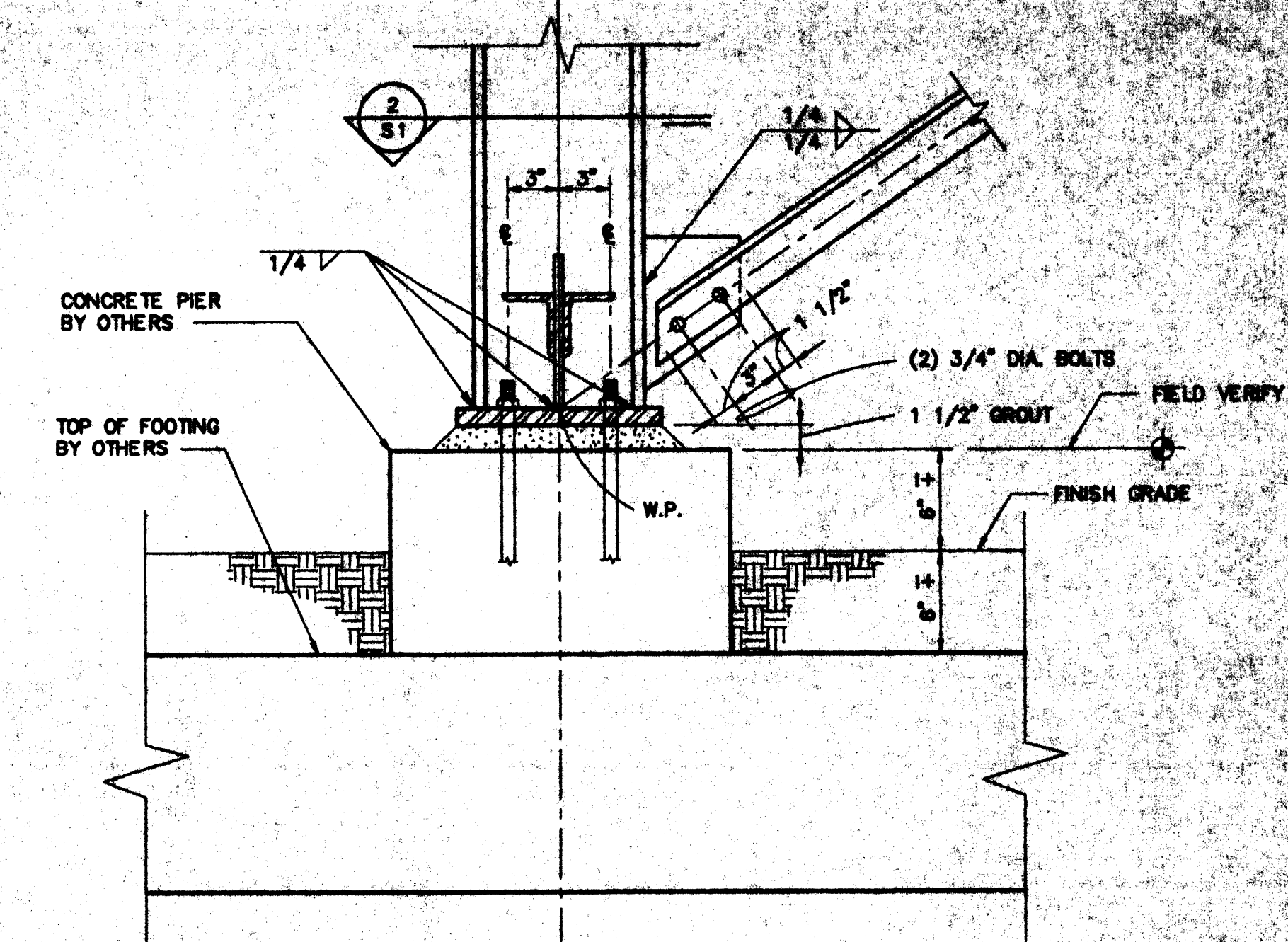
10



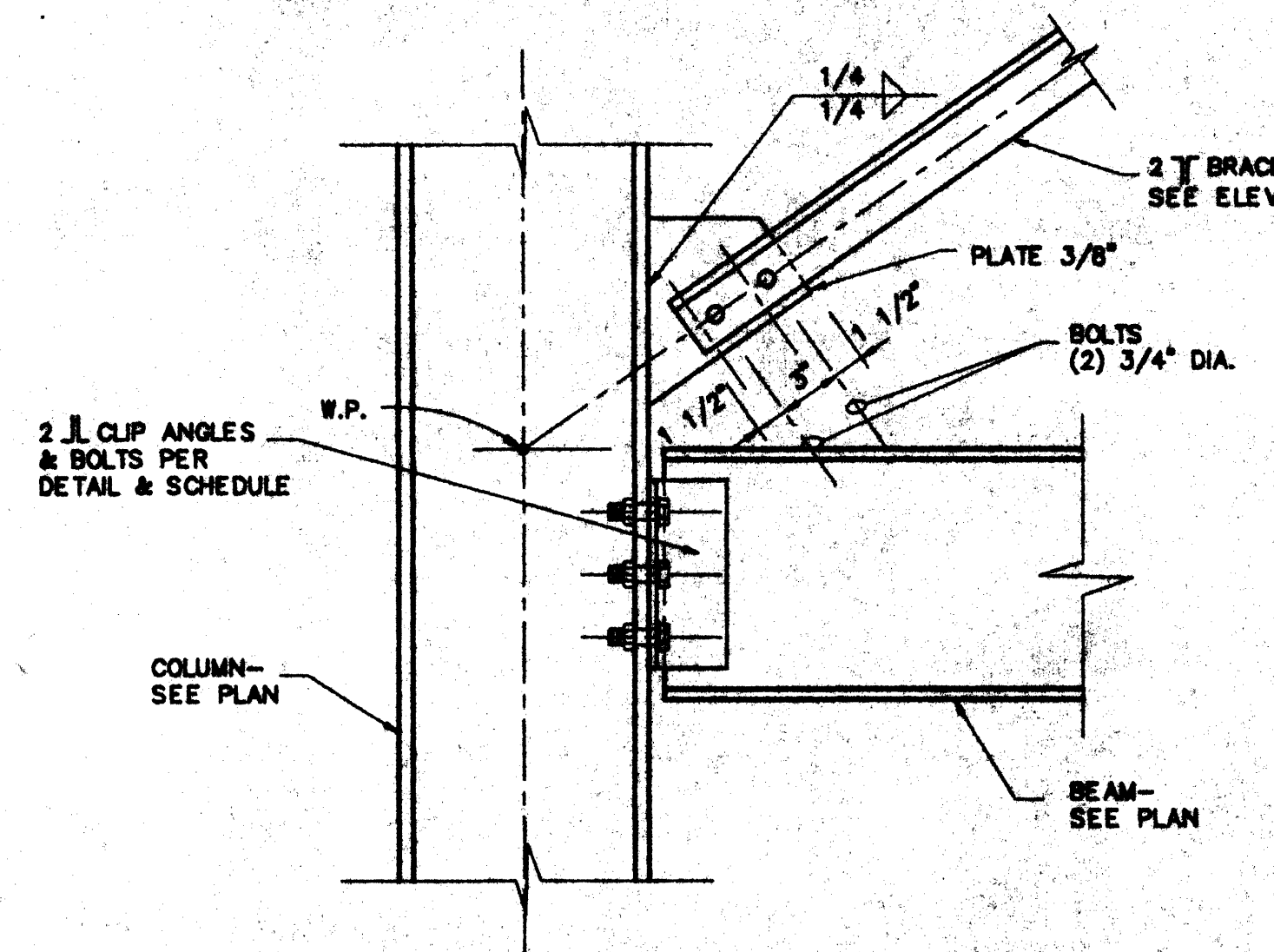
7 BRACE BOT. AT COLUMN WEB



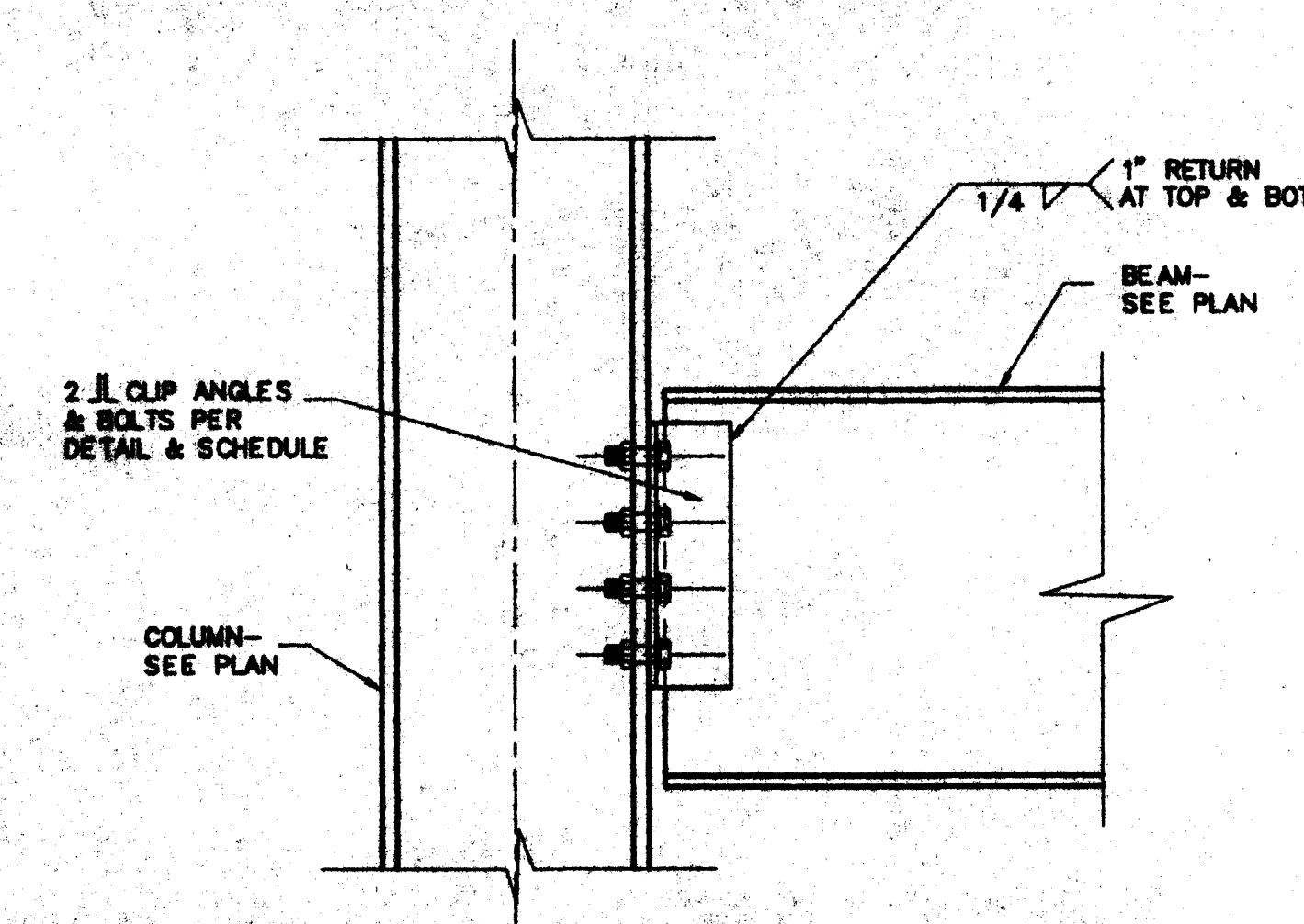
4 BEAM TO COLUMN WEB



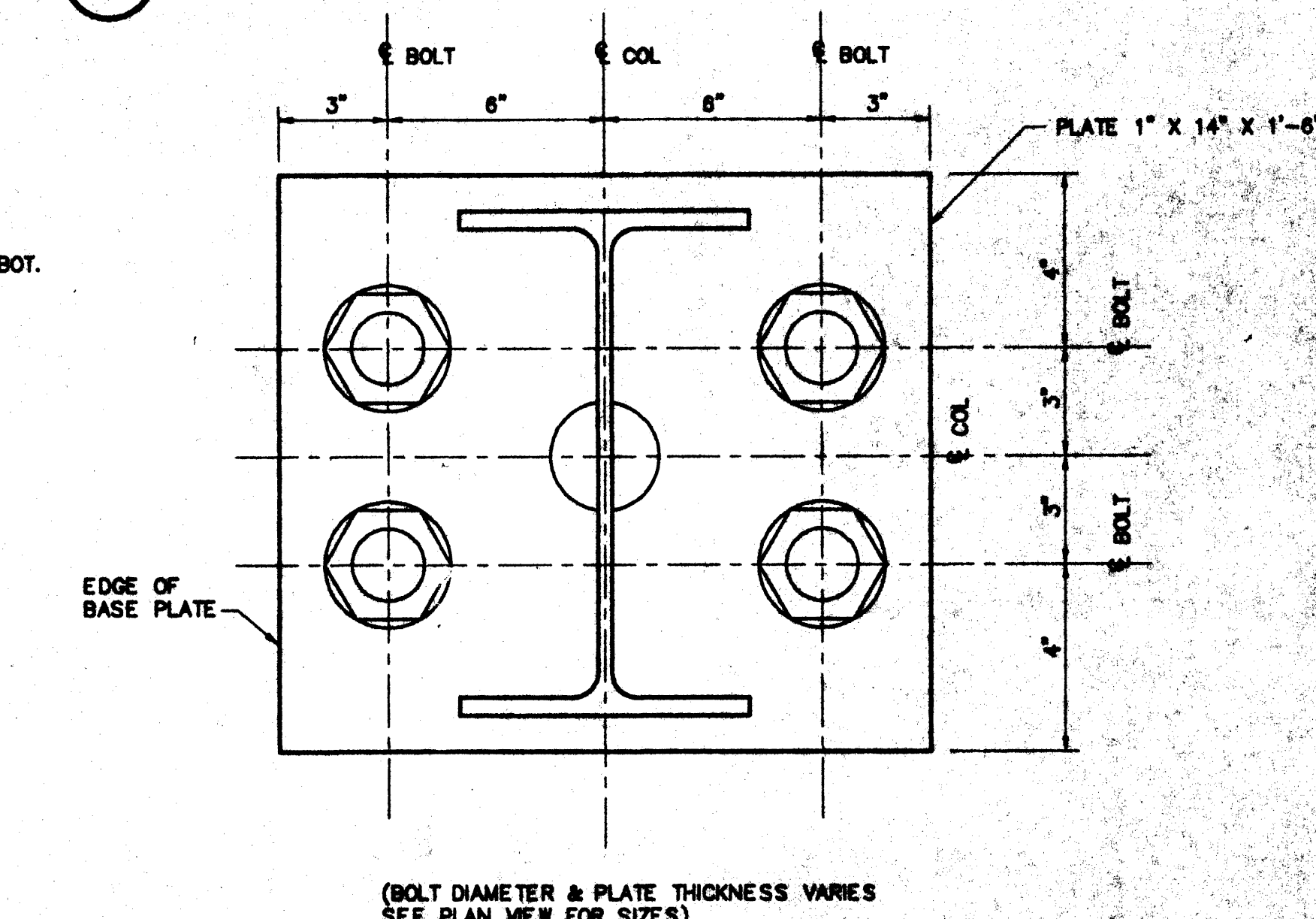
1 COLUMN BASE DETAIL



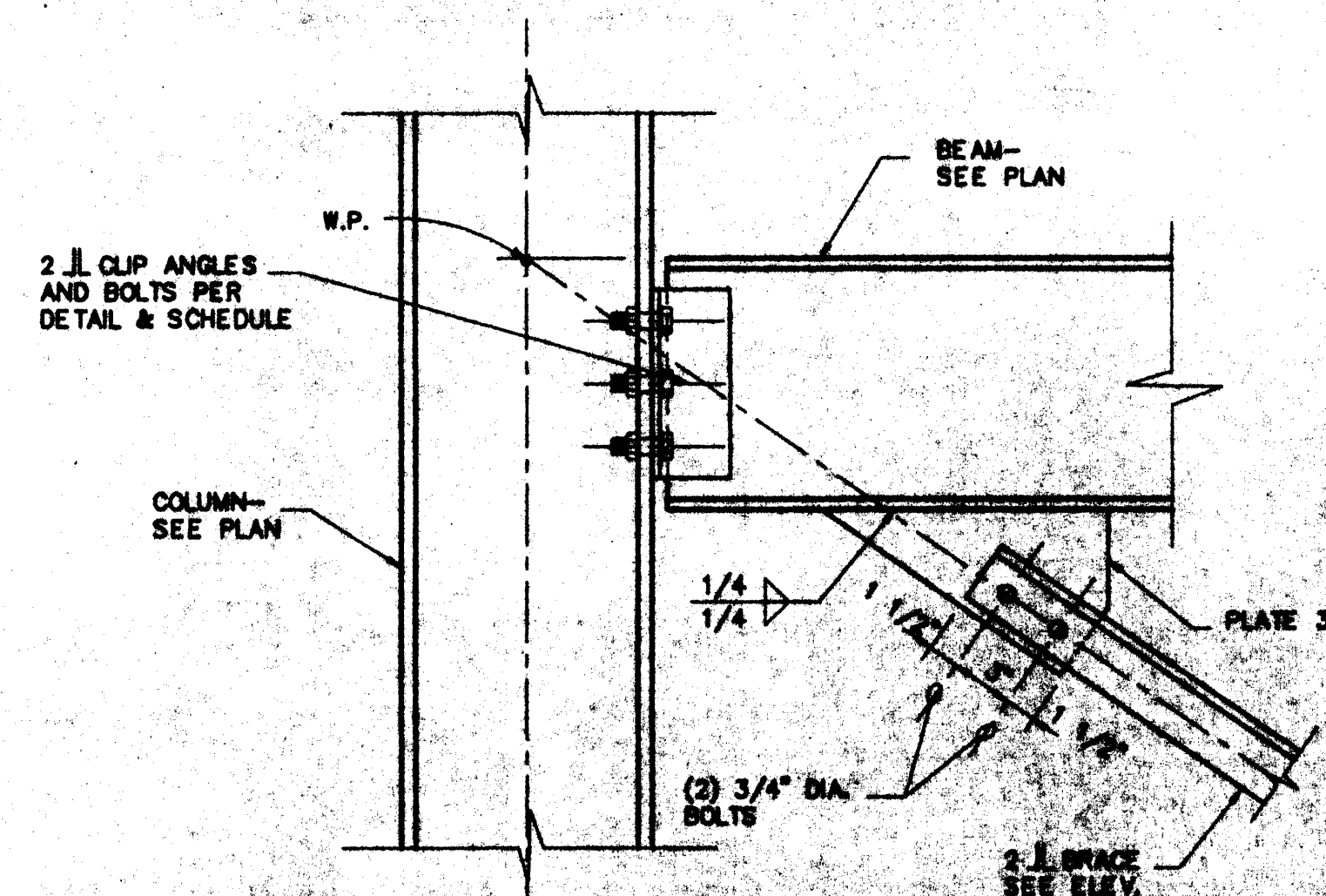
8 BRACE BOT. AT COLUMN FLANGE



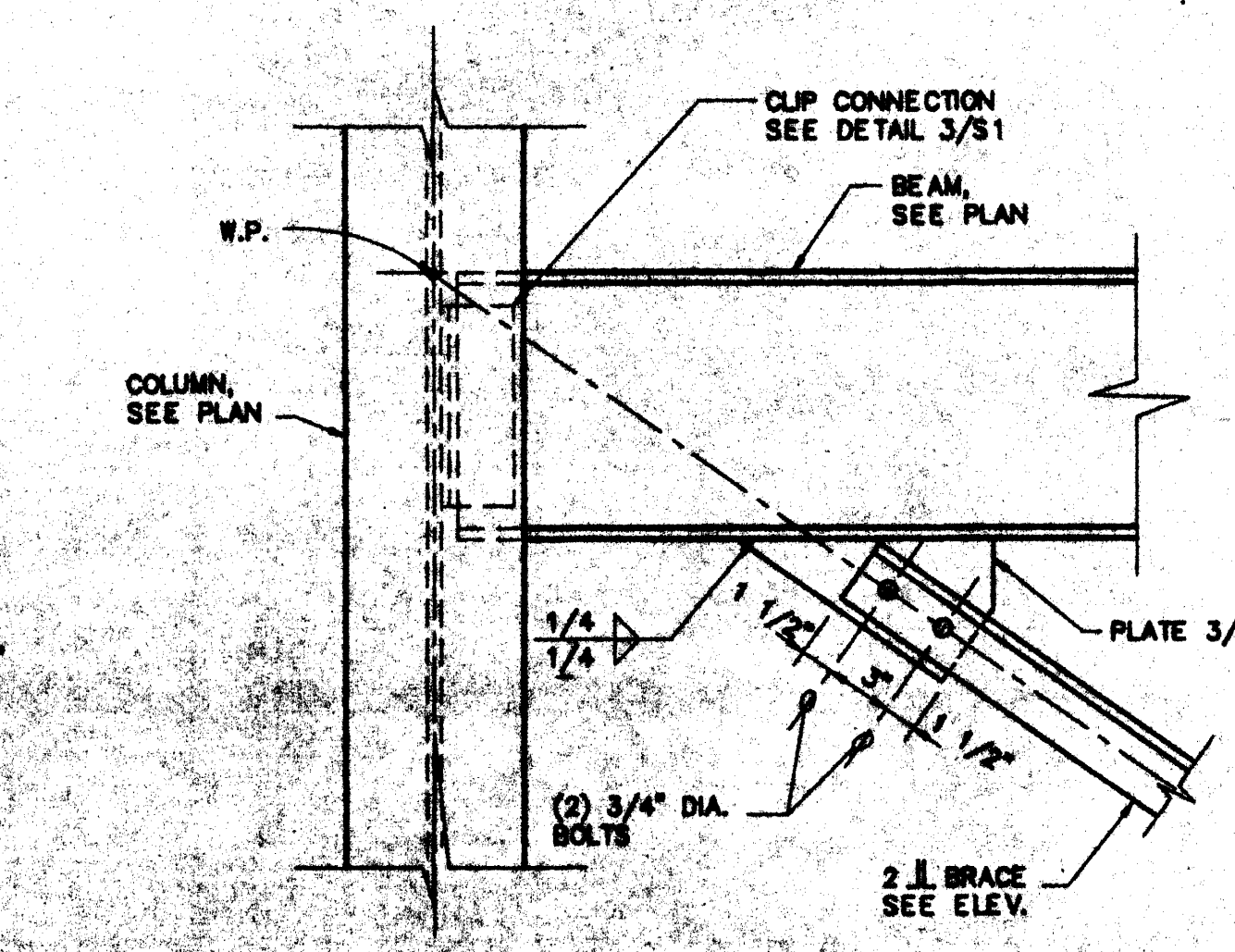
5 BEAM TO COLUMN FLANGE



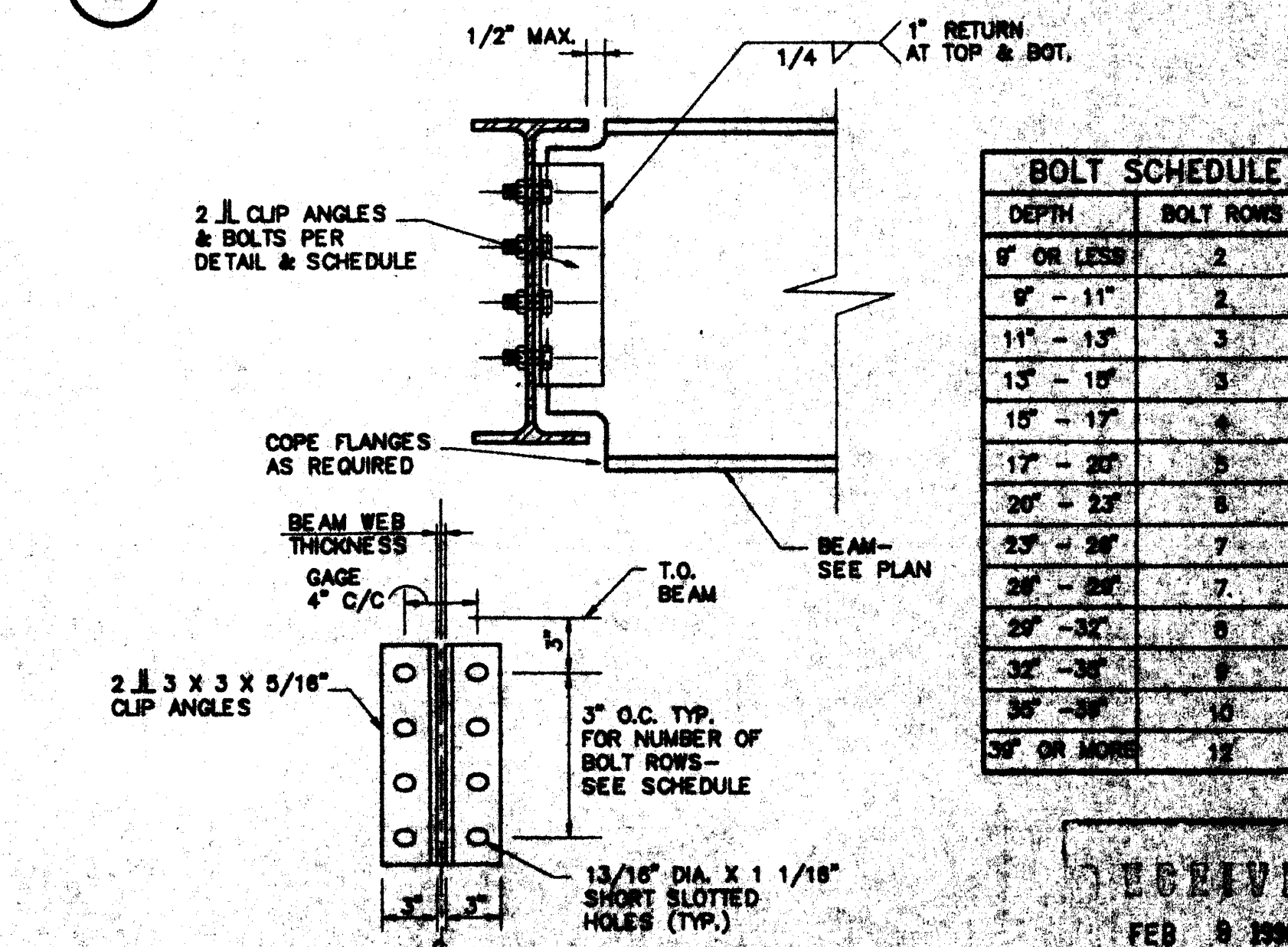
2 COLUMN BASE PLATE



9 BRACE TOP AT COLUMN FLANGE



6 BRACE TOP AT COLUMN WEB



3 BEAM TO BEAM CONN.

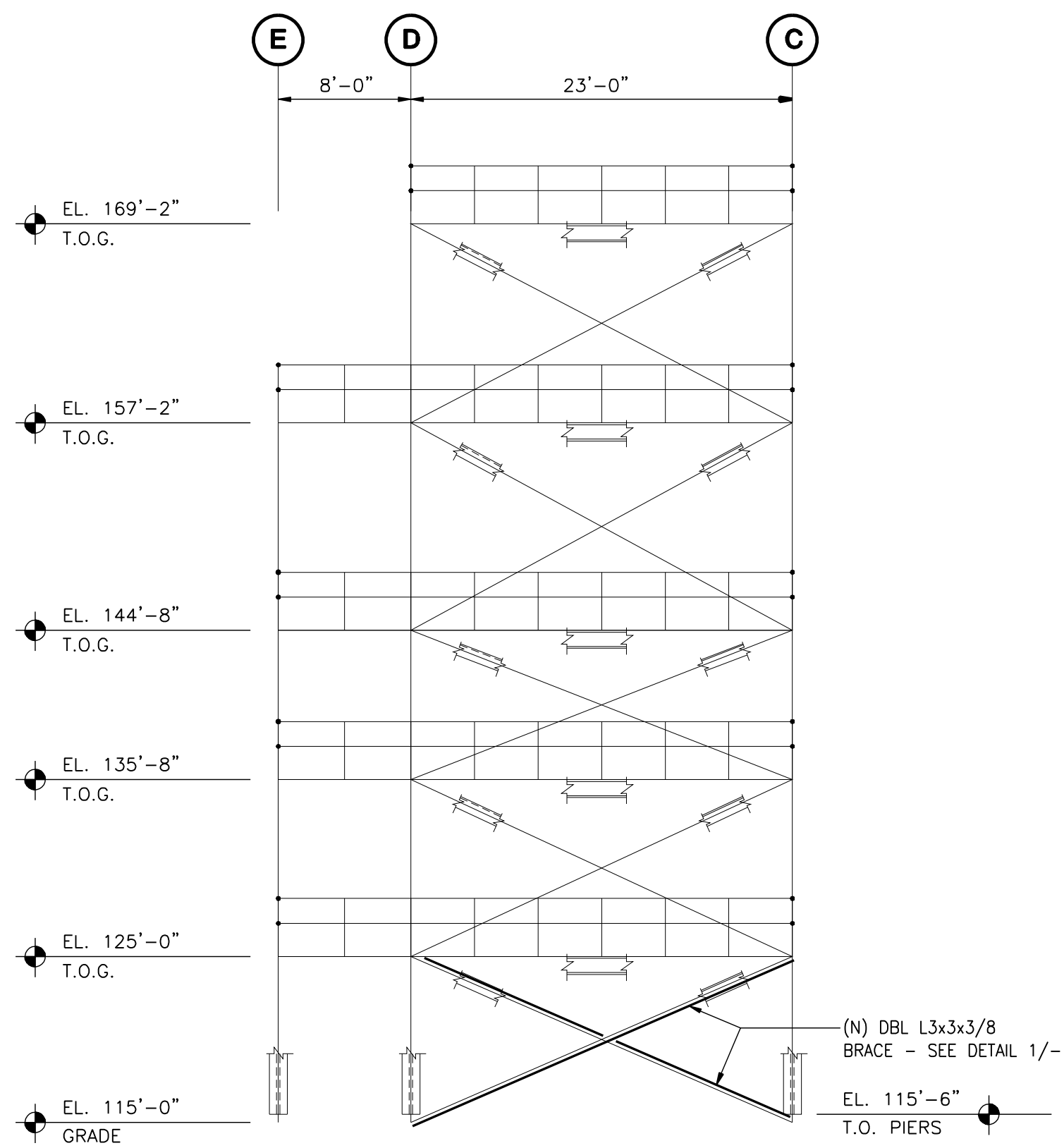
FEB 12 1996
CHAVOND-BARRY

RECEIVED
FEB 9 1996
1996

A.V. SCHWAN & ASSOC., INC.
CONSULTING ENGINEERS
1000 E. CAMDEN RD. STE. 200
TULSA, OKLAHOMA 74104
(918) 438-1111 FAX (918) 438-1112

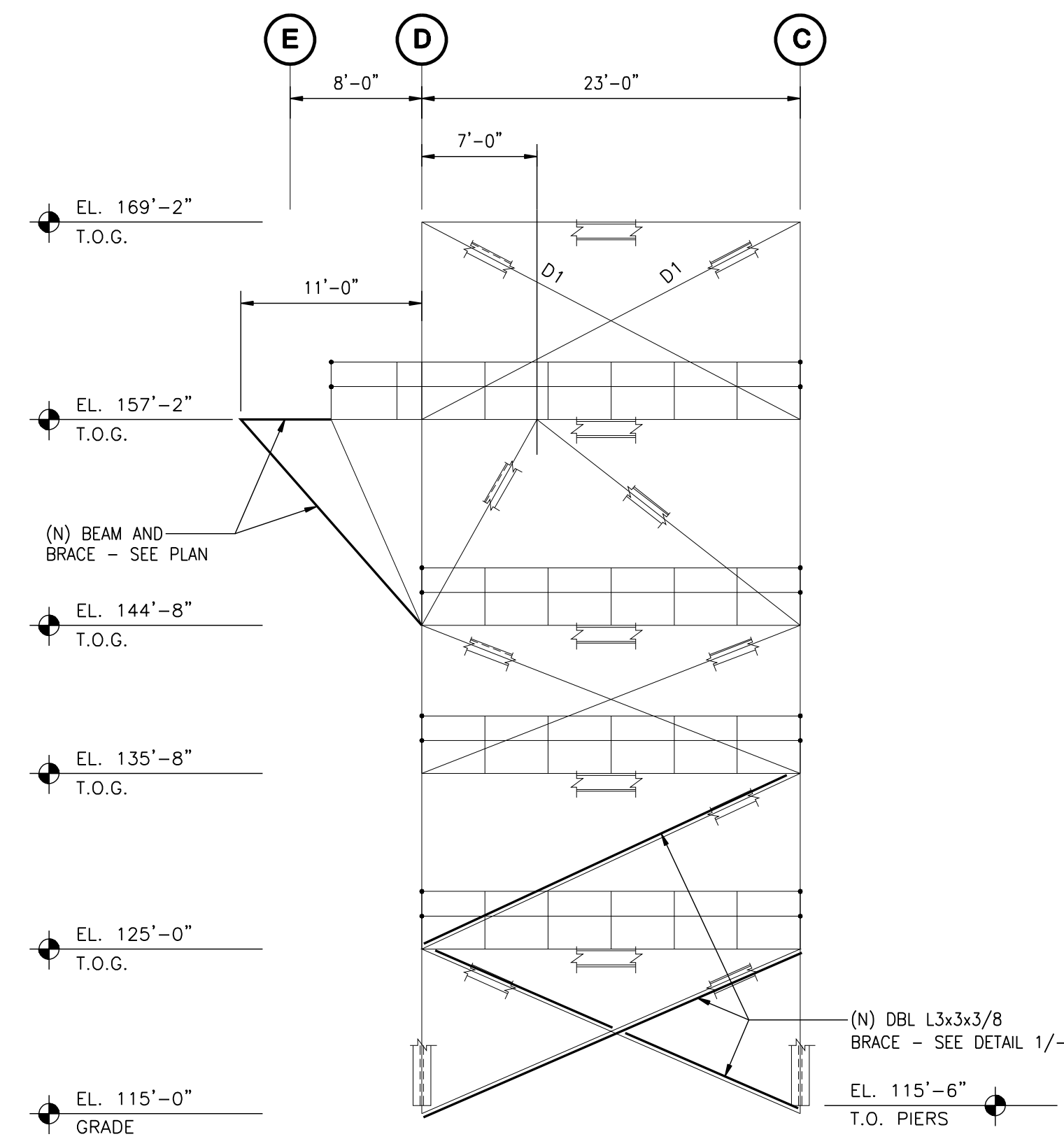
FINCH-HODGINS CARBON REACTION FURNACE
TYPICAL DETAILS
FINCH-HODGINS CARBON REACTION FURNACE
TYPICAL DETAILS

S1

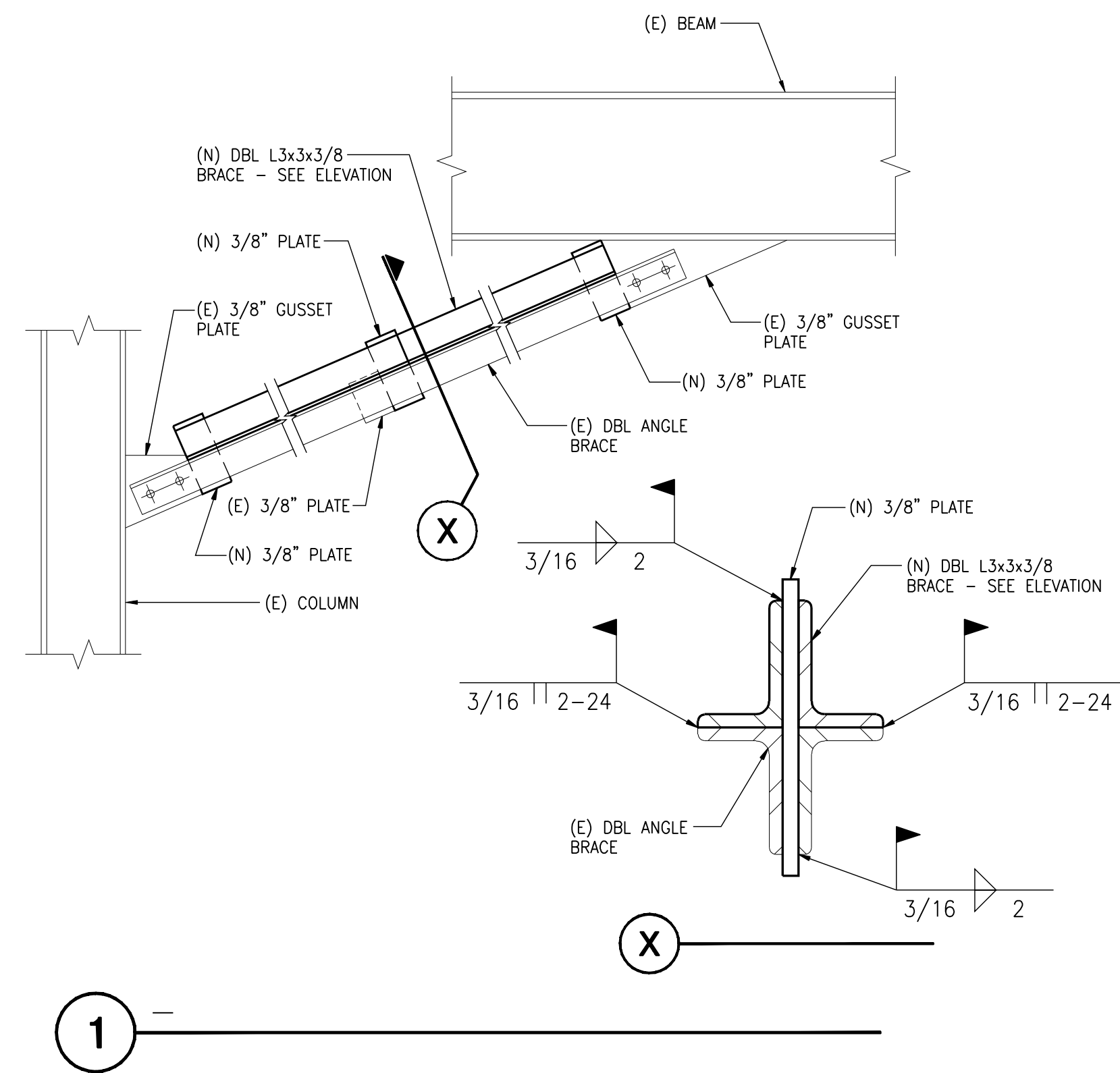


EXISTING ELEV. ALONG GRID ④
(LOOKING EAST) SCALE: 1/8"=1'-0"

NOTE: CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS PRIOR TO FABRICATION AND ERECTION



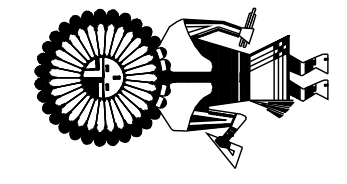
EXISTING - ELEV. ALONG GRID ⑥
(LOOKING EAST) SCALE: 1/8"=1'-0"



1

REVISIONS	
△	-

A.V.SCHWAN & ASSOC., Inc.
CONSULTING ENGINEERS
4700 E. THOMAS ROAD, STE. 100
PHOENIX, ARIZONA 85018
(602) 265-4331 522-1788 (FAX)

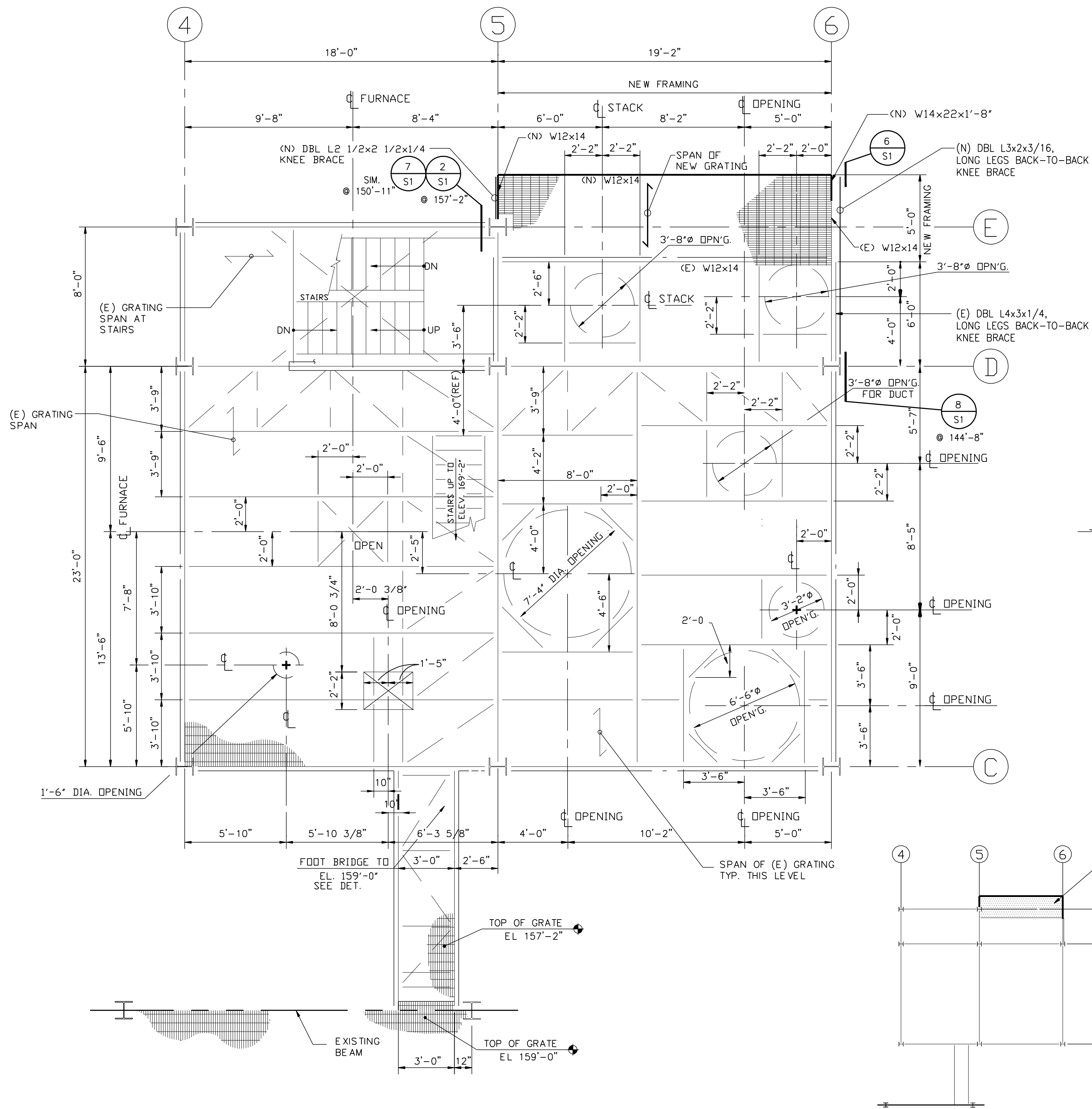


CARBON REACTIVATION FURNACE
STEEL BRACING ELEVATIONS
US FILTER WESTATES
P.O. BOX 3308
2623 MUTHAR STREET
PARKER, AZ 85344

JOB NO.: **5094**
DRAWN: **AKT**
DESIGNED: **JG**
APPROVED: **SAS**
DATE: **8/28/02**

SHEET TITLE:
BRACING ELEVATIONS

SHEET NUMBER:
S3



FRAMING PLAN AT T.O.G. EL 157'-2"

T.O.S. AT -1 1/4" U.N.O.

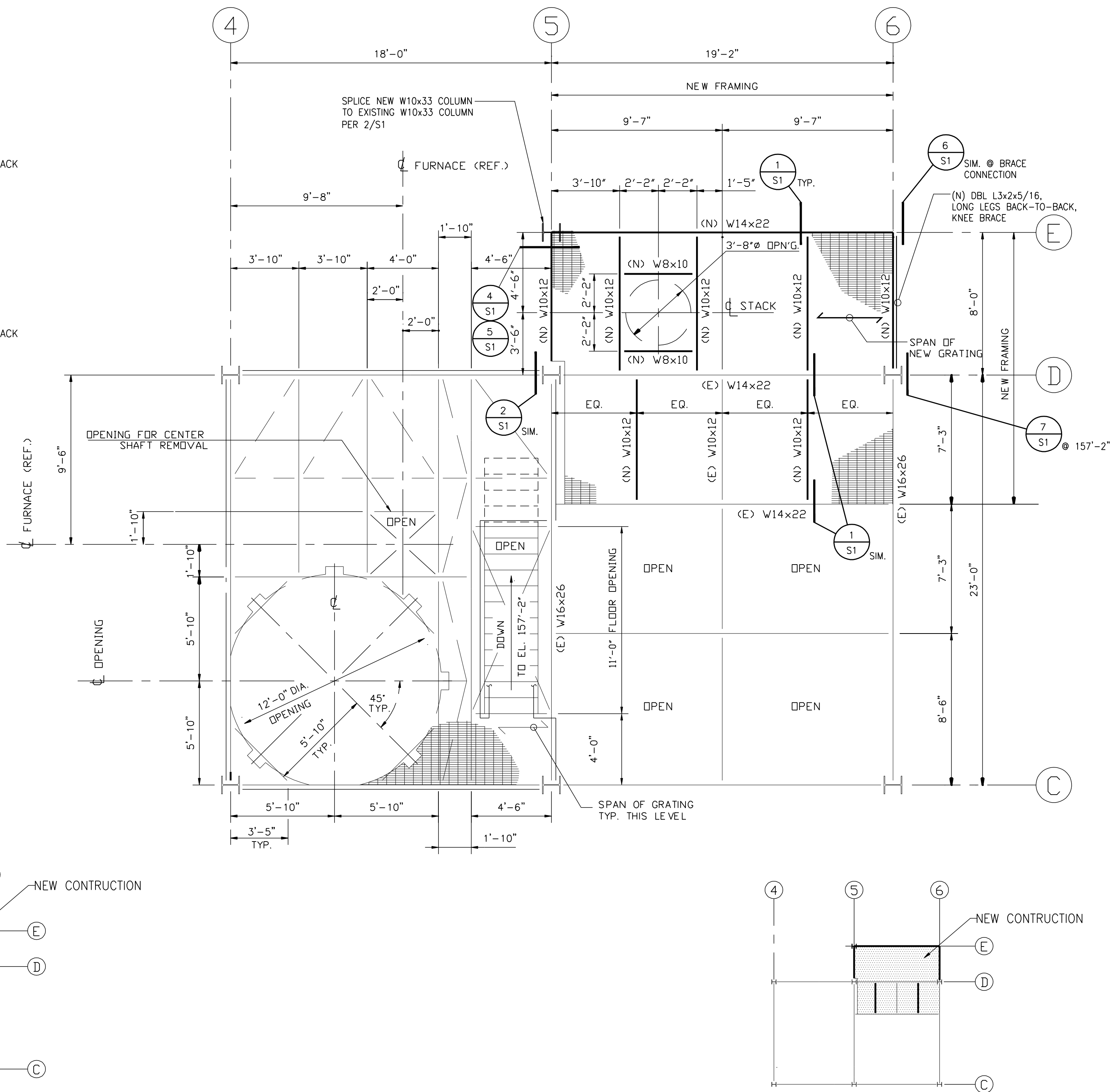
NOTES:

STRUCTURAL STEEL:

- ALL GRATING TO BE RECTANGULAR STL. 1 1/4" X 3/16" X 1 3/16" O.C. BEARING BARS.
- ALL OPENINGS IN GRATING SHALL BE BANDED.

PAINTING:

- PRIOR TO APPLICATION OF ANY COATINGS, STEEL PARTS SHALL BE SANDBLASTED TO SSPC-6, COMMERCIAL BLAST CLEANING.
- IMMEDIATELY THEREAFTER PARTS SHALL BE GIVEN (1) PRIME COAT OF VALSPER CORP. EPOXY PRIMER NO. 13F62, SHOP APPLIED, TO PREVENT RUST.
- AN INTERMEDIATE COAT OF VALSPER CORP. HI-BUILD EPOXY 89 SERIES SHALL BE APPLIED AFTER PRIMER HAS DRIED FOR 24 HOURS. TINT COATING TO APPROXIMATE COLOR OF FINISH COAT.
- ONE (1) FINISH COAT OF VALSPER CORP. URETHANE ENAMEL V40 SERIES SHALL BE FIELD APPLIED AFTER ERECTION OF PARTS. COLOR SHALL BE IN ACCORDANCE WITH COLOR CODE AS APPROVED BY OWNER.



FRAMING PLAN AT T.O.G. EL 169'-2"

T.O.S. AT -1 1/4" U.N.O.

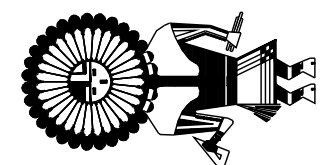
NOTE: CONTRACTOR SHALL VERIFY
ALL EXISTING CONDITIONS
PRIOR TO FABRICATION
AND ERECTION

REVISIONS	
△	-

A.V.SCHWAN & ASSOC., Inc.

CONSULTING ENGINEERS

4700 E. THOMAS ROAD, STE. 100
PHOENIX, ARIZONA 85018
(602) 265-4331 522-1788 (FAX)



CARBON REACTION FURNACE

STEEL FRAMING PLANS

AT BIL. 157'-2" & 169'-2"

US FILTER W8STATES
P.O. BOX 3308
2523 MUTAHAR STREET
PARKER, AZ 85344

JOB NO.: 5094

DRAWN: AKT

DESIGNED: JG

APPROVED: SAS

DATE: 8/28/02

SHEET TITLE:

FRAMING
PLAN

SHEET NUMBER:

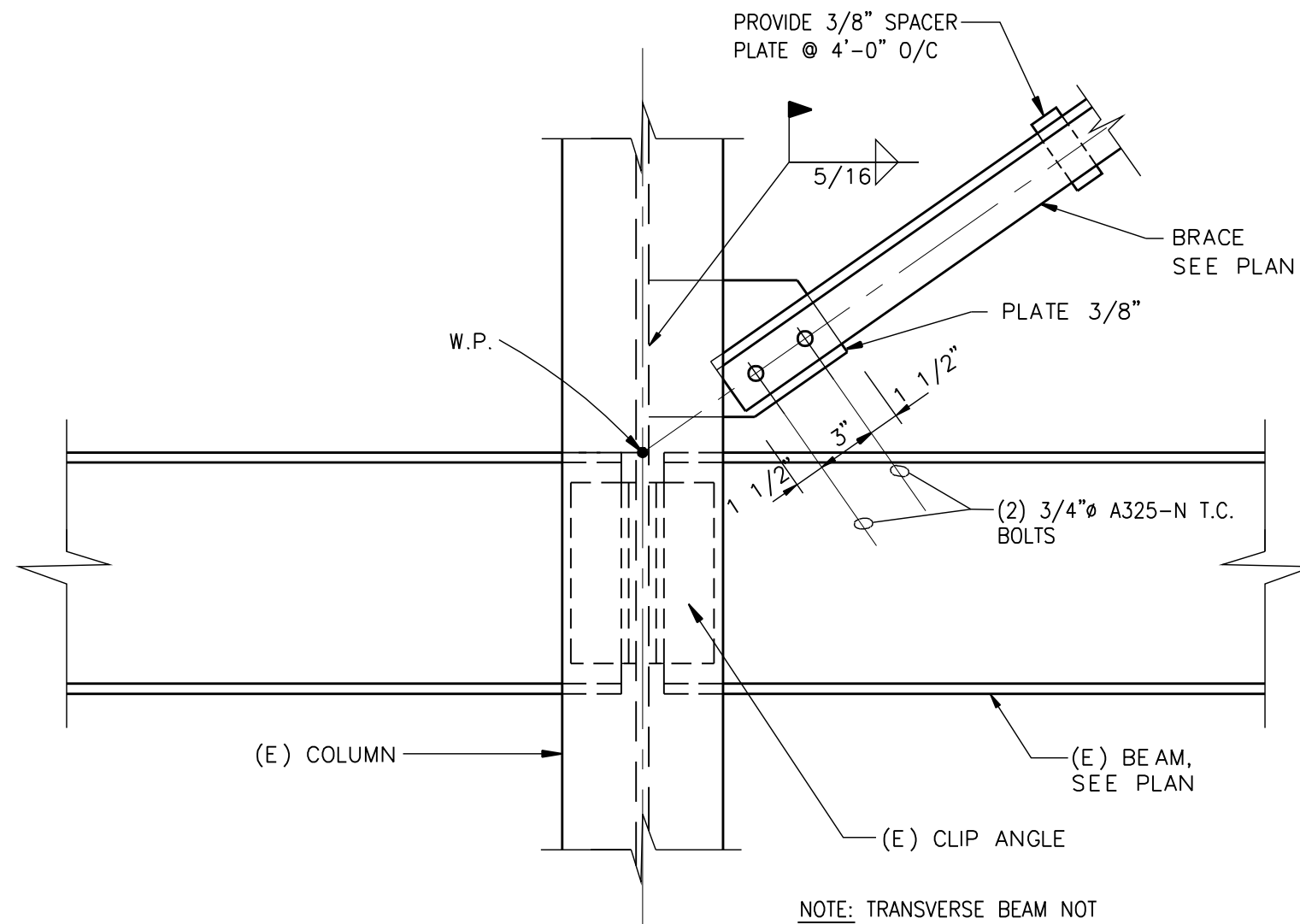
S2

GENERAL STRUCTURAL NOTES

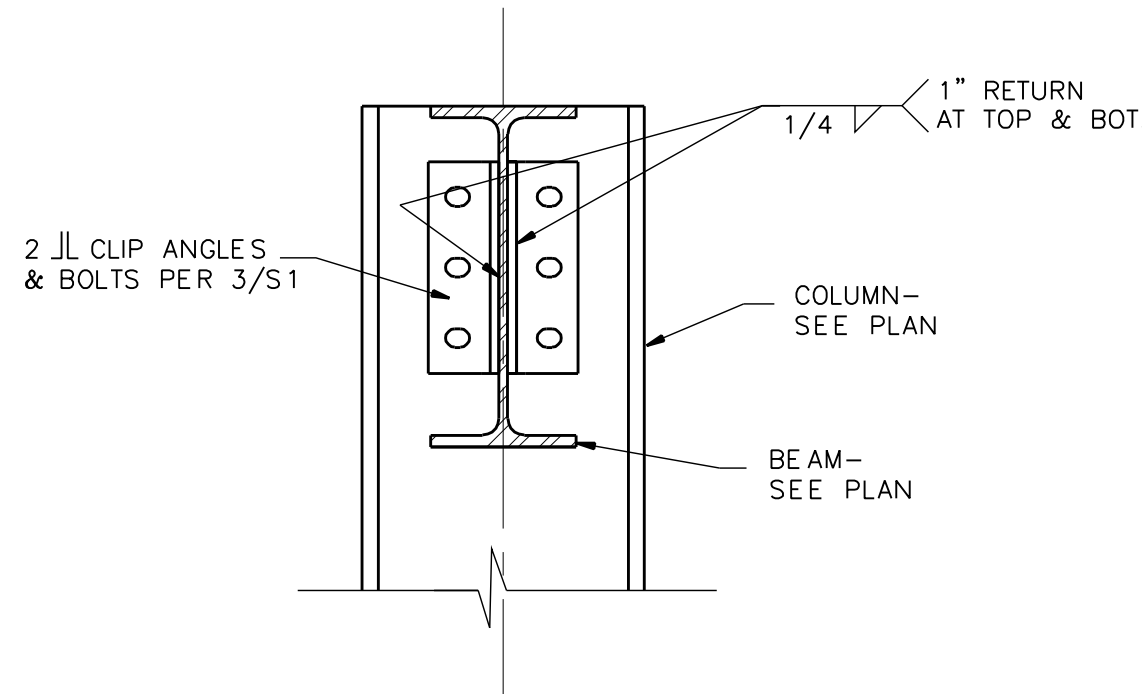
- I. DESIGN CRITERIA
- A. BUILDING CODE:
1. CITY OF PARKER : UNIFORM BUILDING CODE, 1994
- B. LOADINGS:
1. TYPICAL FLOOR LIVE LOAD = 100 PSF
 2. SEISMIC - CITY OF PHOENIX, "Z" FACTOR = 0.25
 3. WIND LOAD - 100 MPH ZONE - EXPOSURE C
 4. SEISMIC ZONE 3: Z=0.30
- II. MATERIALS:
- A. STRUCTURAL AND MISCELLANEOUS STEEL:
1. MATERIAL PROPERTIES:
 - a. TO BE ASTM A 36 UNLESS NOTED OTHERWISE.
 - b. ALL STEEL TO BE DETAILED, FABRICATED AND ERECTED IN ACCORDANCE WITH A.I.S.C. SPECIFICATIONS, LATEST ADDITION.
 2. WELDING: FOR STRUCTURAL STEEL TO BE IN ACCORDANCE WITH A.W.S. REQUIREMENTS FOR E70XX ELECTRODES.
 3. BOLTS:
 - a. ALL BOLTS TO BE 3/4" DIAMETER ASTM A 325-N T.C. UNLESS NOTED OTHERWISE.
- III. EXECUTION:
- A. GENERAL:
1. STRUCTURAL NOTES SHALL BE USED ALONG WITH THE SPECIFICATIONS. WHERE THE STRUCTURAL NOTES, DRAWINGS OR SPECIFICATIONS DISAGREE, THE CONTRACTOR MAY REQUEST A CLARIFI-

CATION DURING THE BIDDING PERIOD. OTHERWISE THE MORE STRINGENT REQUIREMENTS SHALL CONTROL.
 2. PROVIDE ALL TEMPORARY BRACING, SHORING, GUYING OR OTHER MEANS TO AVOID EXCESSIVE STRESSES AND TO HOLD STRUCTURAL ELEMENTS IN PLACE DURING CONSTRUCTION. ESTABLISH AND VERIFY ALL OPENINGS AND INSERTS FOR MECHANICAL, ELECTRICAL AND PLUMBING WITH THE APPROPRIATE TRADES, DRAWINGS AND SUBCONTRACTORS PRIOR TO CONSTRUCTION.
 3. STRUCTURAL DETAILS: DETAILS ARE APPLICABLE WHERE INDICATED BY SECTION CUT, BY NOTE OR BY DETAIL TITLE. PROVIDE SIMILAR DETAILS AT SIMILAR CONDITIONS UNLESS NOTED OTHERWISE. THE CONTRACTOR MAY REQUEST A CLARIFI-

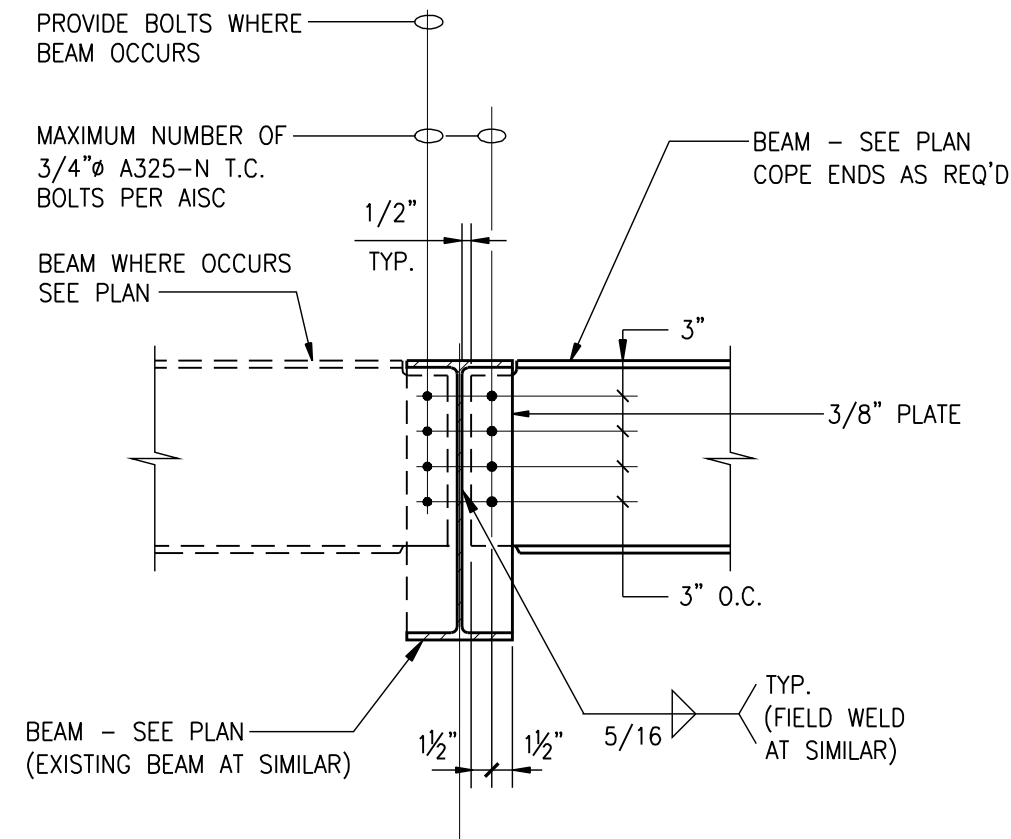
CATION DURING THE BIDDING PERIOD OTHERWISE THE MORE STRINGENT REQUIREMENTS SHALL CONTROL.
 4. EXISTING CONDITIONS: CONTRACTOR SHALL VERIFY IN THE FIELD ALL DIMENSIONS AND CONDITIONS OF THE EXISTING STRUCTURE PRIOR TO BEGINNING ANY PERTINENT WORK. NOTIFY THE ARCHITECT/ENGINEER OF ANY DISCREPANCIES BETWEEN THE DRAWINGS AND ACTUAL CONDITIONS.
 5. DEMOLITION:
 - a. CONTRACTOR SHALL VERIFY IN THE FIELD ALL EXISTING CONDITIONS. ANY DISCREPANCIES BETWEEN THE DRAWINGS AND THE ACTUAL FIELD CONDITIONS SHALL BE REPORTED TO THE ARCHITECT/ENGINEER PRIOR TO CONTINUING ANY WORK.
 - b. CONTRACTOR SHALL EXERCISE EXTREME CARE DURING DEMOLITION TO AVOID DAMAGING THOSE PORTIONS OF THE STRUCTURE TO REMAIN. THE CONTRACTOR SHALL NOTIFY THE ARCHITECT/ENGINEER IMMEDIATELY OF ANY DAMAGE TO THE STRUCTURE TO REMAIN.
 - c. ALL METHODS USED SHALL BE CAREFULLY PLANNED AND SHALL BE APPROPRIATE TO THE WORK TO BE DONE. THE EXISTING STRUCTURE TO REMAIN SHALL NOT BE SUBJECTED TO ANY SUDDEN OR EXCESSIVE FORCES WHICH MIGHT ADVERSELY AFFECT THE INTEGRITY OF THE STRUCTURE.



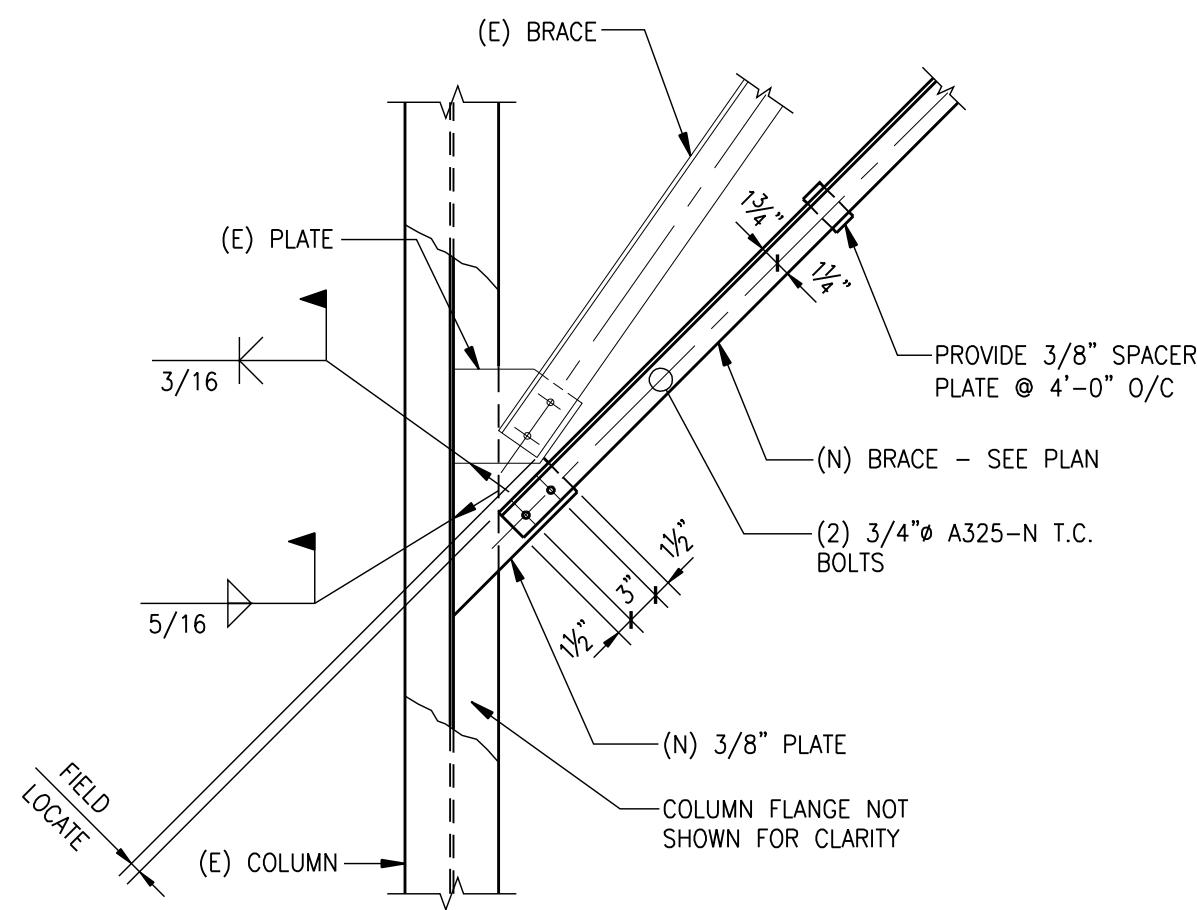
7 BRACE BOT. AT COLUMN WEB



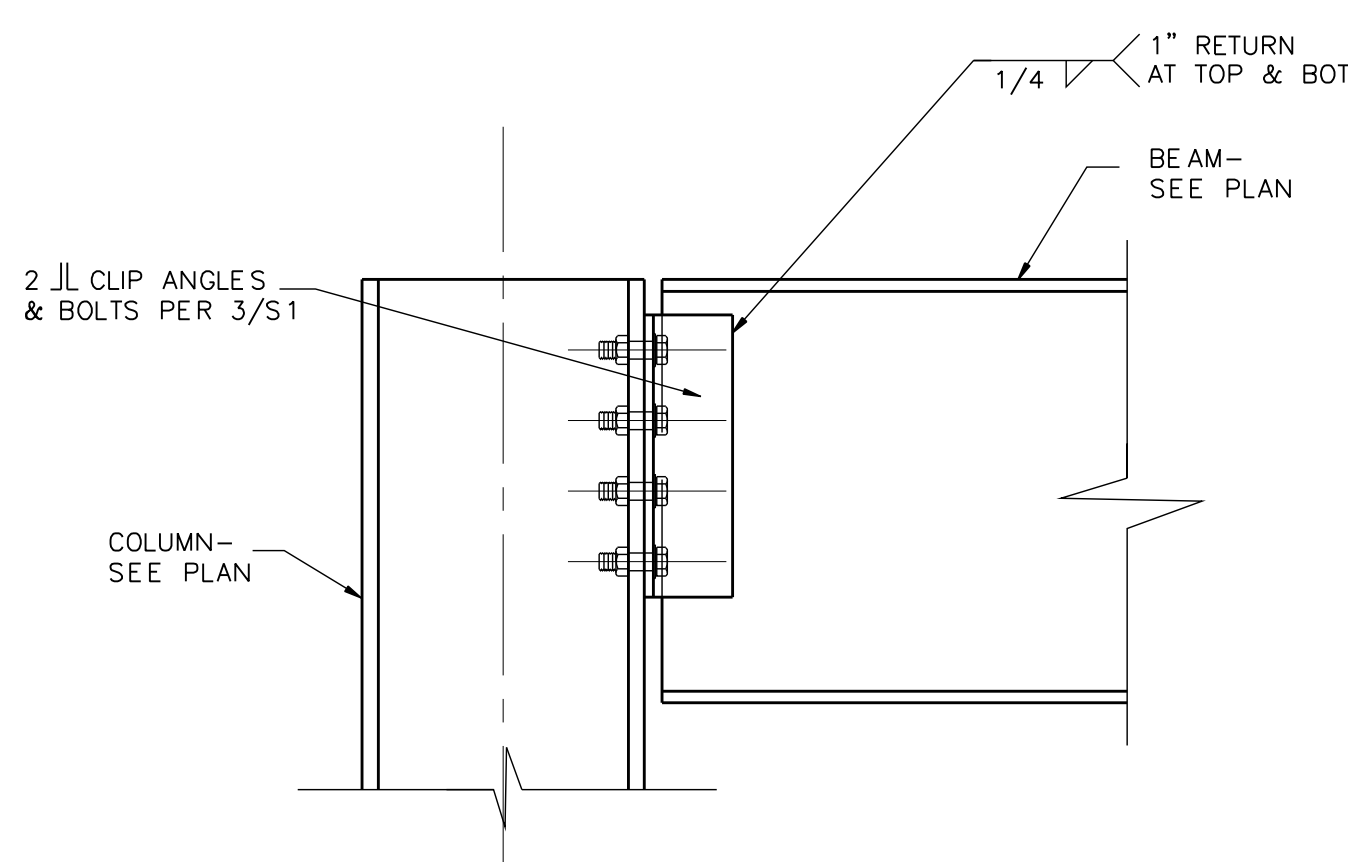
4 BEAM TO COLUMN WEB



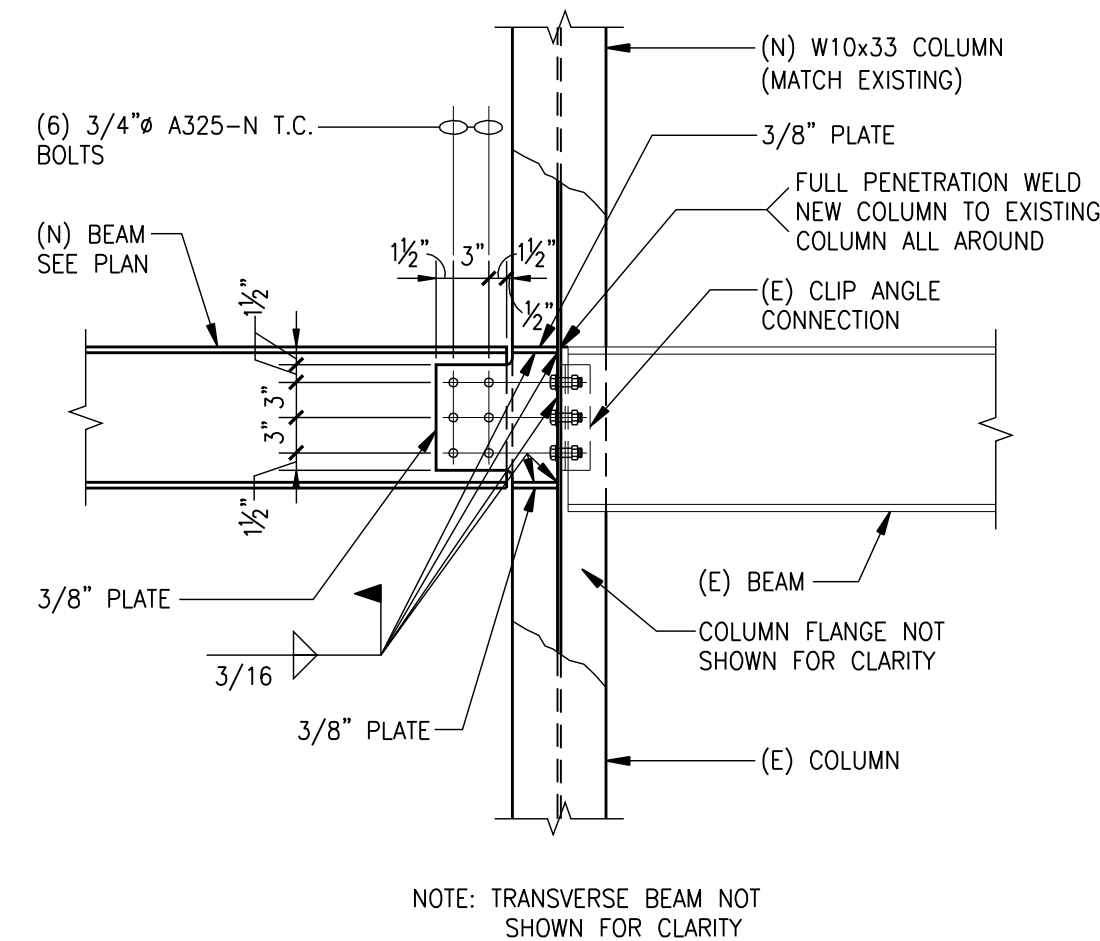
1



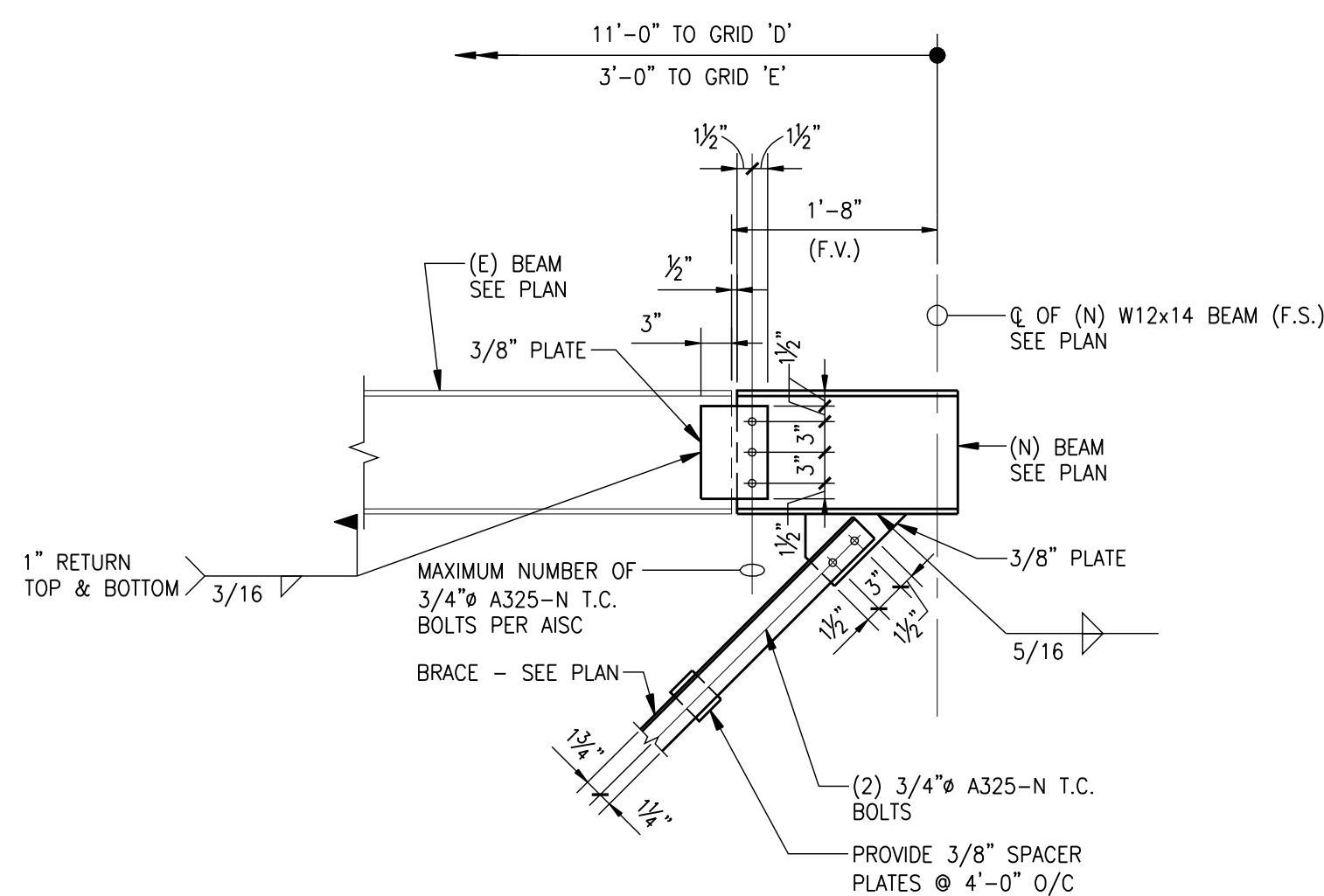
8 BRACE BOT. AT COLUMN FLANGE



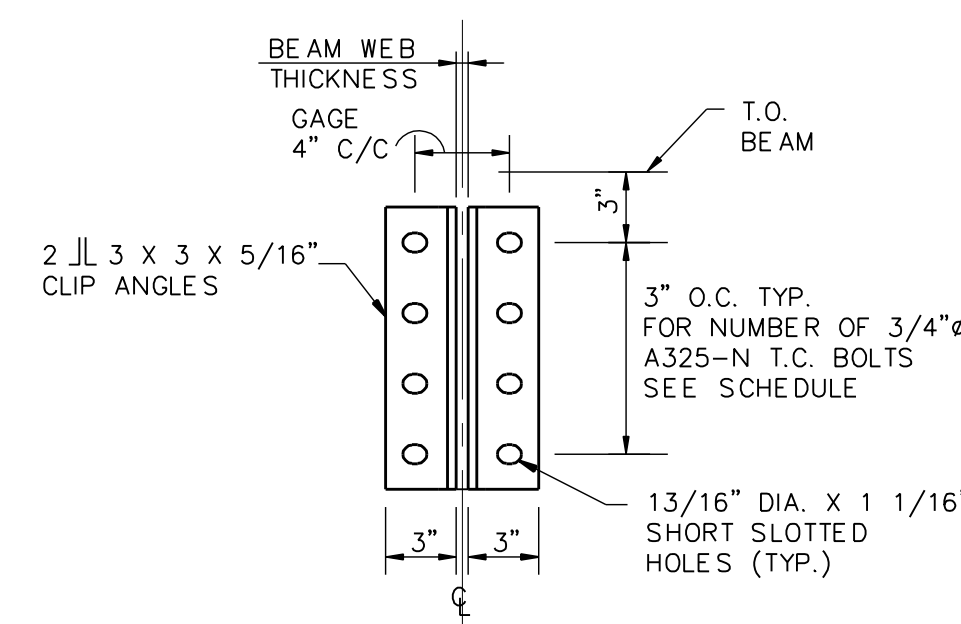
5 BEAM TO COLUMN FLANGE



2



6 BRACE TOP AT COLUMN WEB

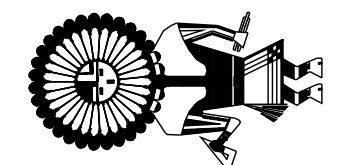


3 TYPICAL CLIP-ANGLE CONNECTION

BOLT SCHEDULE	
DEPTH	BOLT ROWS
9" - 11"	2
11" - 13"	3
13" - 15"	3

REVISIONS	
△	-

A.V.SCHWAN & ASSOC., Inc.
CONSULTING ENGINEERS
4700 E. THOMAS ROAD, STE. 100
PHOENIX, ARIZONA 85018
(602) 266-4331 622-1788 (FAX)



CARBON REACTION FURNACE
TYPICAL DETAILS
US FILTER WESTATIS
P.O. BOX 3308
2623 MUTAHAR STREET
PARKER, AZ 85344

JOB NO.: **5094**
DRAWN: **AKT**
DESIGNED: **JG**
APPROVED: **SAS**
DATE: **8/28/02**

SHEET TITLE:
TYPICAL DETAILS

SHEET NUMBER:

S1

Exhibit B - Design Standards

Structural Calculations for T-18

Rev	Date	Description	prepared by:		JOB NO.	1601794
0	2/9/07	Orig	John F. Bradley, S.E.		SHT	1 OF 28
			Arizona Registered Structural Engineer		DATE	2/9/2007
			Lic. #31856 Atascadero, California		DES. BY	JFB
			FOR	Siemens Water Treatment Tech. Corp.	REV	0
			DESCRIPTION	Double Wall SS304 Carbon Filter Tank		

STRUCTURAL CALCULATIONS FOR

Siemens Water Treatment Tech. Corp.

Double Wall SS304 Carbon Filter Tank

10.67 ft Dia x 7.5 ft Cylindrical Shell Ht x 9.25 ft Tall Cone Bottom

6,400 Gallons

ELEVATED CONE BOTTOM w/ FLAT ROOF

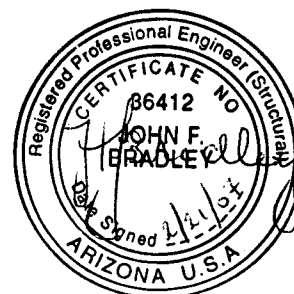
REVISION 0

Dated February 09, 2007

(Original Calc Package)

LOCATED AT

Parker, Arizona



Vessel Manufactured By:

Modern Custom Fabrication

2421 E. California Avenue
Fresno, CA 93721
Ph (559) 264-4741, Fax (559) 237-3413

THESE CALCULATIONS HAVE BEEN PREPARED FOR AND ARE THE PROPERTY OF MODERN CUSTOM FABRICATION (MCF).
THEY MAY CONTAIN INFORMATION DESCRIBING TECHNOLOGY OWNED BY MCF AND DEEMED TO BE COMMERCIALY SENSITIVE.
THEY ARE ONLY TO BE USED IN CONNECTION WITH PERFORMANCE OF WORK BY MCF AND ARE TO BE SAFEGUARDED AGAINST
BOTH DELIBERATE AND INADVERTENT DISCLOSURE TO ANY THIRD PARTY.
REPRODUCTION IN WHOLE OR IN PART FOR ANY PURPOSE OTHER THAN WORK BY MCF IS EXPRESSLY FORBIDDEN.

Modern Custom Fabrication, Inc.
Fresno, California
By: John F. Bradley, S.E.
February 9, 2007

Customer: Siemens Water Technologies Corp.
Location: Parker, Arizona
Double Wall SS304 Carbon Filter Tank
AWWA D100-05, IBC 2003

Table of Contents

	<u>Page</u>
I Design Summary	3
II Design Criteria & Sketch	4
III Cylindrical Shell	5
IV Cone Bottom & Compression Ring	7
V Wind Design	11
VI Seismic Design	14
VII Stiffened Roof	20
VIII Anchor Support Ring	22
IX Reinforcement of Shell Penetrations	26
X Lift Lugs	27
XI Support Structure Design Loads	28

Modern Custom Fabrication, Inc.
 Fresno, California
 By: John F. Bradley, S.E.
 February 9, 2007

Customer: Siemens Water Technologies Corp.
 Location: Parker, Arizona
 Double Wall SS304 Carbon Filter Tank
 AWWA D100-05, IBC 2003

Design Summary

Product Stored: Spent Activated Carbon Slurry
 Specific Gravity: 1.50
 Max Temperature: 150° F
 Design Pressure: Atmospheric
 Design Codes: 1) AWWA D100-05
 2) IBC 2003 for Wind & Seismic
 Wind Design: IBC 2003 & AWWA: Basic Wind Speed = 90 mph (3-second gust), Exposure C, $I_w = 1.15$
 Seismic Design: IBC 2003 & AWWA: $S_s = 0.23g$, $S_1 = 0.15g$, $I_e = 1.5$, Site Class D

Description

This tank is a double-wall cylindrical upper tank with a double-wall conical bottom for use inside a water treatment plant near Parker, Arizona. Product is spent activated carbon slurry, i.e. a mix of granular carbon material and water. Material used for the tank construction is SS304 stainless steel. Inner shell is separated from outer shell by (10) evenly spaced bent plate channel spacers @ 1 3/8" tall. These spacers are attached to outside of inner shell. Both inner and outer shells are 1/4" plate.

Design Criteria

Specific gravity of slurry mix is provided by customer at 1.50 (conservative). Tank is designed for atmospheric pressure (no internal pressure or vacuum) and ambient temperature. Design codes specified for this tank are AWWA D100-05 and IBC 2003. There are no American codes that specifically address all components for elevated cone bottom tanks, so other codes & design procedures will be used as appropriate (e.g. API 620 for the cone bottom & compression girder). Allowable steel stresses are taken per AWWA D100-05. Wind and seismic loads are calculated both per AWWA and IBC, and governing cases are used for design. Load combinations are taken per IBC 2003. Seismic design values above are governing values from those provided by customer and those from USGS website for Parker, AZ.

Design Methodology

The Inner tank shell is the normal pressure boundary; the outer tank is used for leak containment. Under normal loading, inner tank transfers loads to the outer tank at discreet locations of spacers. In event of leak in inner tank, space between the two tanks may fill up, subjecting the outer shell to uniform product pressure. Tank load is supported at a continuous anchor ring about 4'-3" up from cone-cylinder junction.

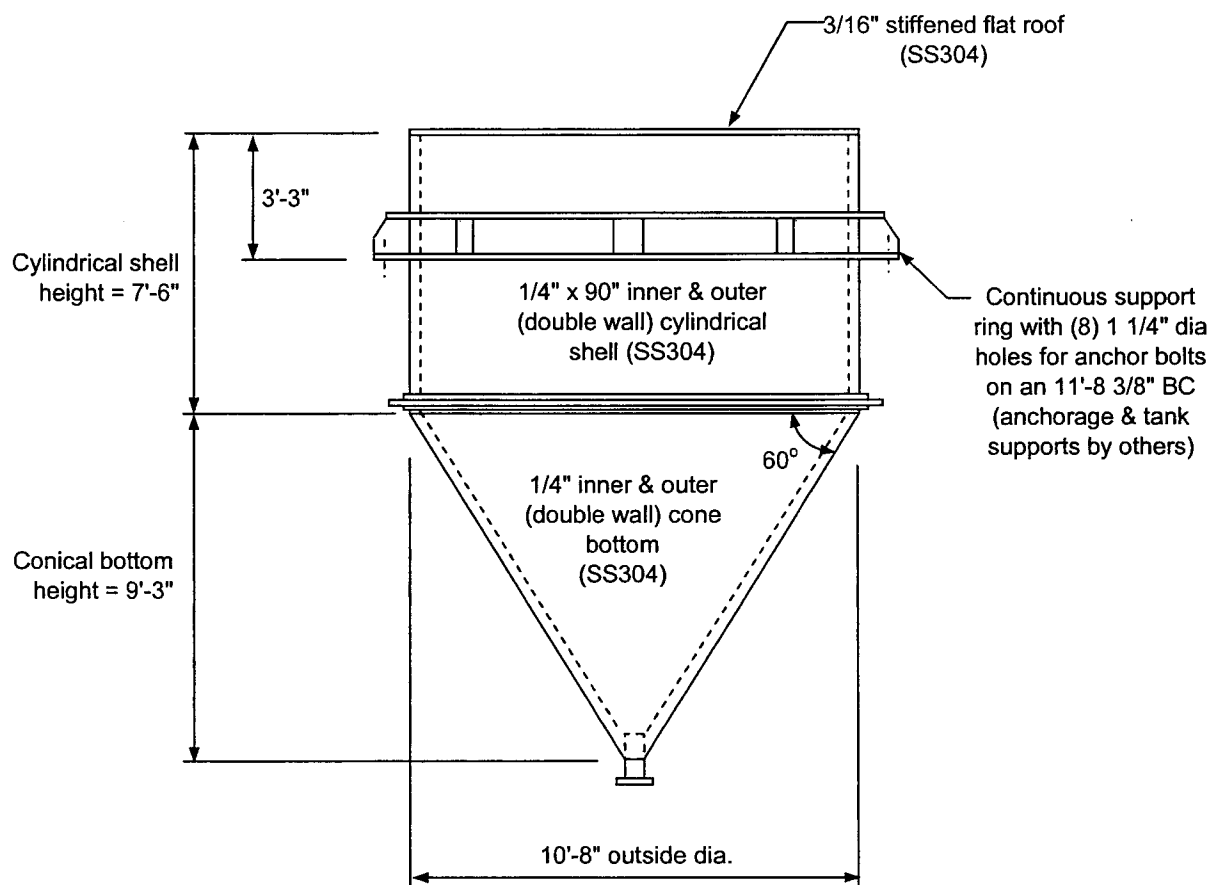
Support structure and anchorage/attachment to supports are by others and are not included in these calculations. It is assumed that wind pressure can act on entire tank shell. For lateral load calculations, it is assumed that tank is a pendulum-type structure rigidly supported at anchor bolt circle. For seismic & wind OTM calculations, lateral resisting loads due to structure & contents above the anchor bolt circle are conservatively ignored. Design loads at anchorage locations for use by others to design tank support structure are provided as the last sheet in this calculation package.

Modern Custom Fabrication, Inc.
 Fresno, California
 By: John F. Bradley, S.E.
 February 9, 2007

Customer: Siemens Water Technologies Corp.
 Location: Parker, Arizona
 Double Wall SS304 Carbon Filter Tank
 AWWA D100-05, IBC 2003

Design Criteria & Sketch

Product Stored: Spent Activated Carbon Slurry
 Specific Gravity: 1.50
 Max Temperature: 200° F
 Design Pressure: Atmospheric
 Design Codes: 1) AWWA D100-05
 2) IBC 2003 for Wind & Seismic
 Wind Design: IBC 2003 & AWWA: Basic Wind Speed = 90 mph (3-second gust), Exposure C, $I_w = 1.15$
 Seismic Design: IBC 2003 & AWWA: $S_s = 0.23g$, $S_1 = 0.15g$, $I_e = 1.5$, Site Class D



Weights: Empty Vessel = W_{empty} = 14.0 k
 Product (full to top of outer tank) = 88.5 k
 Tank + full product = W_{full} = 102.5 k

Outside Shell Diameter = D_o = 128 in
 Cylindrical Shell Thickness (inner & outer) = t_c = 0.25 in
 Conical Bottom Thickness (inner & outer) = t_b = 0.25 in

Internal pressure = 0 psig
 Internal vacuum = 0 psig

Modern Custom Fabrication, Inc.
 Fresno, California
 By: John F. Bradley, S.E.
 February 9, 2007

Customer: Siemens Water Technologies Corp.
 Location: Parker, Arizona
 Double Wall SS304 Carbon Filter Tank
 AWWA D100-05, IBC 2003

Hydrostatic Design of Cylindrical Shell

Required shell plate thickness: (Per AWWA D100)

$$t = [2.6HDG]/(sE) + CA$$

Where: H = Height of liquid from top capacity level to bottom of shell course (= "Design Depth" below)

D = 10.7 ft (tank dia)

G = 1.50 (specific gravity tank contents)

s = 15000 psi

E = 0.85 (joint efficiency)

CA = 0 in

Factored hoop stress force = 42 pli/ft = 2.6DG = Hydrostatic hoop force in lbs/inch of shell circumference
 per ft of product depth

DESIGN FOR STATIC PRODUCT - ONE FOOT METHOD

Ring No.	Ring Ht (in)	Material	Allowable Stress = sE (psi)	Design Depth (ft)	Design Pt Elevation (ft)	Hoop Force @ Des. Pt. (pli)	Min t req'd [incl. c.a.] (in)	Thickness Used (in)	Thk Status	Material Status
Top 1	90.0	SS304	12750	7.50	7.50	270	0.0245	0.25	OK	OK

Modern Custom Fabrication, Inc.
Fresno, California
By: John F. Bradley, S.E.
February 7, 2007

Customer: Siemens Water Technologies Corp.
Location: Parker, Arizona
Double Wall SS304 Carbon Filter Tank
AWWA D100-05, IBC 2003

Check Cylindrical Shell for Radial Load @ Channel Spacers

Analysis of Bracket Load on Cylindrical Tank

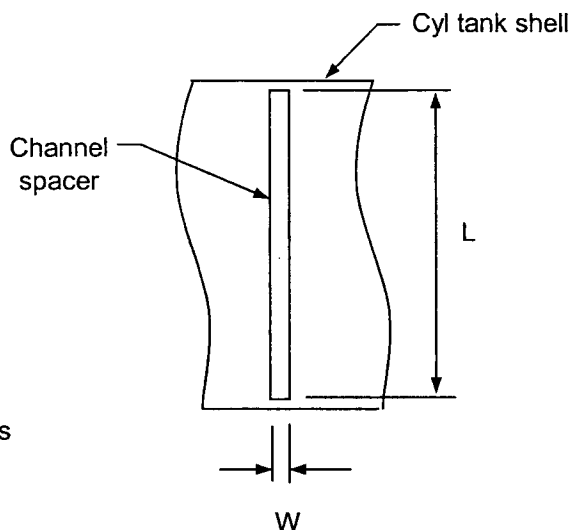
(Check radial thrust on outer shell due to load from inner shell concentrated @ channel spacer)

Tank Shell - Material & Dimensions

Tank Radius (R) =	64 in
Shell Thickness (t) =	0.250 in
Longitudinal Stress (S_L) =	50 psi
Hoop Stress (S_H) =	400 psi
Allowable Stress (S_m) =	12750 psi
Yield Stress (F_y) =	30000 psi
Allowable Stress Increase (k) =	1.00
Tensile Stress =	75000 psi

Shell Bracket - Dimensions & Loads

Bracket Width (W) =	3.0 in
Bracket Length (L) =	86.0 in
Longitudinal Moment (M) =	0 in-lbs
Radial Load (Q) =	6270 lbs (Wt of 1/10th Vol of Cyl)



Allowable Loads

Max. allowable loading limiting longitudinal stress to $0.75F_y$:

$$M_1 = (0.035WkF_y t^2)[6 + 6\beta L + (\beta L)^2] = 184087 \text{ in-lbs}$$

$$Q_1 = (0.208WkF_y t^2 \beta)(2 + \beta L) = 11136 \text{ lbs}$$

$$\text{Where: } \beta = 1.285/(Rt)^{1/2} = 0.3213$$

Max. allowable loading limiting circumferential stress to $0.75F_y$:

$$M_2 = (0.063WkF_y t^2)[6 + 6\beta L + (\beta L)^2] = 331356 \text{ in-lbs}$$

$$Q_2 = (0.379WkF_y t^2 \beta)(2 + \beta L) = 20291 \text{ lbs}$$

Unity Checks

- 1) $M/M_1 + Q/Q_1 = 0.563 < 1.0 \text{ OK!}$
- 2) $M/M_2 + Q/Q_2 = 0.309 < 1.0 \text{ OK!}$
- 3) $(M/M_1 + Q/Q_1)(0.75F_y)(k) + S_L = 12719 \text{ (psi)} < 3 S_m \text{ OK!}$
- 4) $(M/M_1)(0.75F_y)(k) + S_L = 50 \text{ (psi)} < 1.5 k S_m \text{ OK!}$
- 5) $(M/M_2 + Q/Q_2)(0.75F_y)(k) + S_L = 7353 \text{ (psi)} < 3 S_m \text{ OK!}$
- 6) $(M/M_2)(0.75F_y)(k) + S_L = 400 \text{ (psi)} < 1.5 k S_m \text{ OK!}$

Where:

$$\begin{aligned} 3 S_m &= 38250 \text{ (psi) but not greater than } 75000 \text{ (psi)} \\ 1.5 k S_m &= 19125 \text{ (psi)} \end{aligned}$$

Therefore Outer Shell is OK for Radial Load Concentrated @ Channel Spacer

Modern Custom Fabrication, Inc.
Fresno, California
By: John F. Bradley, S.E.
February 9, 2007

Customer: Siemens Water Technologies Corp.
Location: Parker, Arizona
Double Wall SS304 Carbon Filter Tank
AWWA D100-05, IBC 2003

Cone Bottom & Compression Ring

Materials & Geometry

Cone Top Diameter (D) = 10.67 ft
Cone Height (H) = 9.25 ft
Cone Material = SS304
Water depth above top of cone = 7.50 ft
Specific Gravity of contents = 1.50
Cone plate thickness = t_c = 0.250 in
Corrosion allowance (cone) = c_c = 0.000 in
Cylindrical shell thickness = t_s = 0.250 in
Corrosion allowance (shell) = c_s = 0.000 in

Allowable Stress

(ref AWWA D100)

Allowable Stress (s) = 15,000 psi
Joint Efficiency (E) = 0.85
Reduced Allowable Stress (sE) = 12,750 psi

Actual Stresses

(per API 620 Sect. 5.10.2.5)

Longitudinal Force = $T_1 = (R_s/2\cos\alpha)[P+W/A_t] = 267 \text{ lbs/in}$
Hoop Force = $T_2 = (PR_s/\cos\alpha) = 360 \text{ lbs/in}$
Where: R_s = shell radius = 64.00 in
 $\alpha = 0.524 \text{ rad}$
 $P = 4.88 \text{ psi}$
 $W = 30190 \text{ lbs}$ (weight of cone & contents)
 $A_t = 12868 \text{ sq in}$

Longitudinal stress = 1067 psi < Reduced Allowable Stress -- OK

Hoop Stress = 1441 psi < Reduced Allowable Stress -- OK

Compression Ring @ Cone to Shell Junction

(per API 620 Sect. 5.12.4.2)

(This analysis assumes uniform inward radial load & compression around compression ring.)

Contributing length of shell = $w_s = 0.6[R_s(t_s - c_s)]^{0.5} = 2.40 \text{ in}$

Contributing length of bottom cone = $w_c = 0.6[R_c(t_c - c_c)]^{0.5} = 2.58 \text{ in}$

Where: $R_s = 64.0 \text{ in}$

$R_c = 73.9 \text{ in}$

Total circumferential force = $Q = T_2w_c + T_{2s}w_s - T_1R_s\sin\alpha = -6860 \text{ lbs}$ (compression)

Where: $T_{2s} = 312 \text{ lbs/in}$

Required area of compression ring region = $Q/(sE) = 0.54 \text{ sq in}$

Actual area provided = $A_c = w_s(t_s - c_s) + w_c(t_c - c_c) + A_{\text{comp band \& girder}} = 4.24 \text{ sq in}$

Area of compression girder is adequate

Req'd moment of inertia of compression girder = $3QR^2/4E = 0.77 \text{ in}^4$

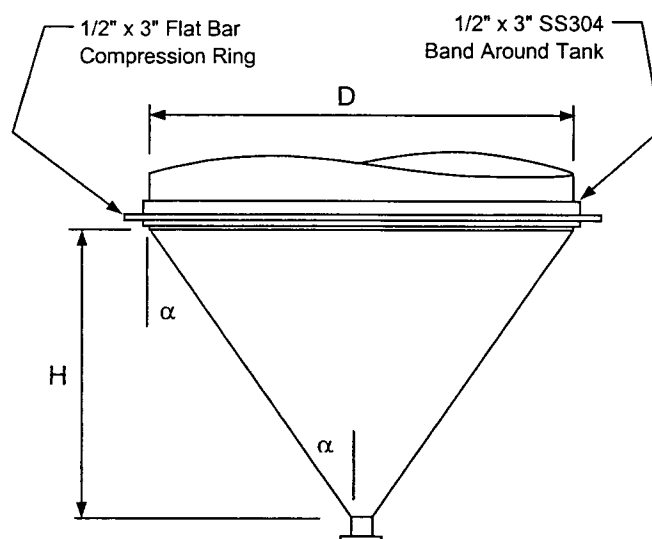
Actual moment of inertia of comp ring region = 6.21 in⁴

Moment of Inertia of compression girder is adequate

Required projection of compression girder = $0.015R_s = 0.96 \text{ in}$ (per API 620 Sect. 5.12.5.1)

Actual horz projection of compression ring region = 5.04 in (horz proj of cone bottom + 1/2" thk ring)

Projection of compression girder is adequate

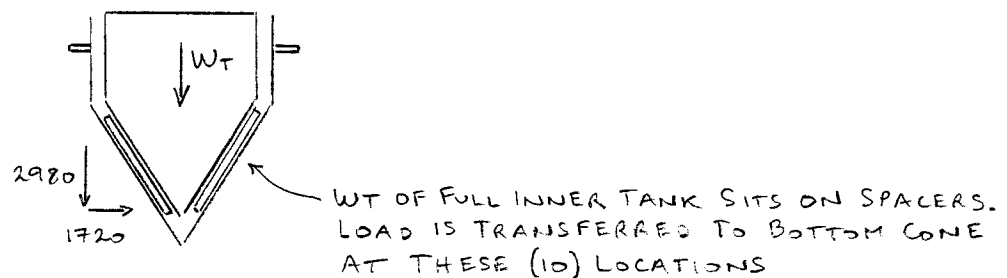


COMPRESSION RING @ CONE-TO-SHELL JUNCTION

LOAD PATH: WEIGHT OF INNER TANK AND CONTENTS PASSES INTO THE OUTER BOTTOM CONE AT THE POINTS OF THE SPACERS BETWEEN THE TWO CONES. THEN THE LOAD IS CARRIED UP THROUGH THE OUTER TANK SHELL TO THE ANCHORAGE SUPPORT RING.

THIS CREATES DISCREET INWARD RADIAL THRUST LOADS ON THE OUTER TANK COMPRESSION RING AT EACH OF THE (10) SPACER LOCATIONS IN THE BOTTOM CONE.

CHECK COMPRESSION RING FOR THESE (10) EQUAL RADIAL LOADS EQUALLY SPACED

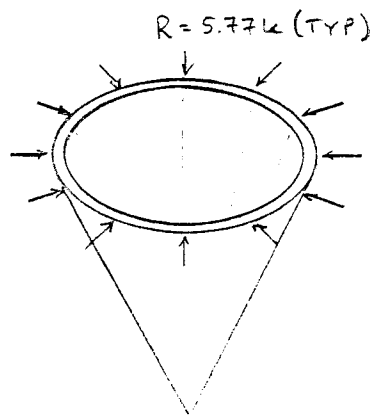


$$\begin{aligned}
 W_T &= \text{WEIGHT OF TANK AND CONTENTS} \approx 100 \text{ k} \\
 \text{LOAD TRAVELLING UP THROUGH OUTER SHELL} &= \frac{100 \text{ k}}{\pi (10.67')} \\
 &= 2980 \text{ plf}
 \end{aligned}$$

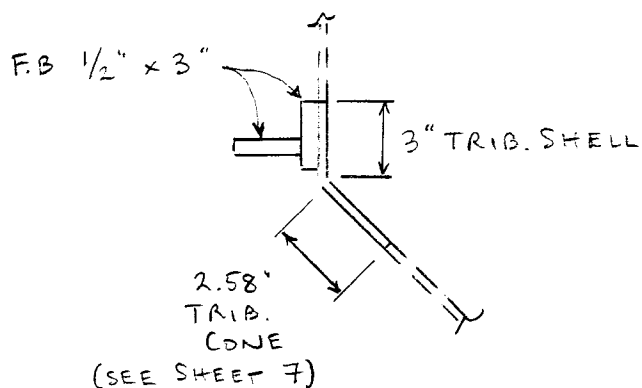
$$\text{RADIAL THRUST INWARD} = (2980 \text{ plf})(\tan 30^\circ) = 1720 \text{ plf}$$

RADIAL LOAD ON COMPRESSION RING @ EACH OF (10) POINTS:

$$R = \frac{(1720 \text{ plf})(\pi)(10.67')}{10} = 5.77 \text{ k}$$



CHECK COMPRESSION RING FOR THIS LOAD CASE

COMPRESSION RING, CONT.COMPRESSION RING REGION

SECTION PROPS (SEE NEXT SHEET)

$$A = 4.395 \text{ in}^2$$

$$S = 2.15 \text{ in}^3$$

THRUST/AXIAL STRESS IN RING:

$$f_a = \frac{T}{A} = \frac{(5.77k)(1.539)}{4.395 \text{ in}^2}$$

$$= 2.0 \text{ ksi (COMPRESSION)}$$

BENDING (AT POINT OF LOAD):

$$f_b = \frac{M}{S} = \frac{(0.0527)(5.77)(64'')}{2.15 \text{ in}^3} = 9.1 \text{ ksi}$$

FOR CLASS 1 STEEL:

 F_a = ALLOWABLE AXIAL STRESS = 15 ksi (AWWA D100-05 TABLE 6) F_b = ALLOWABLE BENDING STRESS = 15 ksi (AWWA D100-05 TABLE 7)

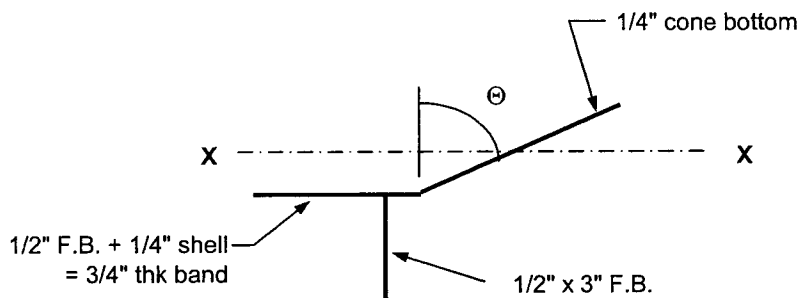
$$\text{UNITY CHECK: } \frac{f_a}{F_a} + \frac{f_b}{F_b} = \frac{2.0}{15} + \frac{9.1}{15} = 0.74 < 1.0$$

✓ OK

∴ COMPRESSION GIRDER IS OK FOR AXIAL LOAD & BENDING
DUE TO INWARD THRUST LOADS CONCENTRATED AT SPACERS

Section Properties of Cone-to-Shell Junction

Section Properties of Cone-to-Shell Junction



	Previous Area	b	d	Theta	a	h	AREA	Y	AY	AY^2	lo
1	-	0.5	3	0	0.000	3.000	1.500	1.500	2.25	3.4	1.13
2	1	3	0.75	0	3.000	3.750	2.250	3.375	7.59	25.6	0.11
3	2	0.25	2.58	60	3.750	5.040	0.645	4.395	2.83	12.5	0.09
4	3	0	0	0	5.040	5.040	0.000	5.040	0.00	0.0	0.00
5	4	0	0	0	5.040	5.040	0.000	5.040	0.00	0.0	0.00
6	5	0	0	0	5.040	5.040	0.000	5.040	0.00	0.0	0.00
7	6	0	0	0	5.040	5.040	0.000	5.040	0.00	0.0	0.00
8	7	0	0	0	5.040	5.040	0.000	5.040	0.00	0.0	0.00
9	8	0	0	0	5.040	5.040	0.000	5.040	0.00	0.0	0.00
10	9	0	0	0	5.040	5.040	0.000	5.040	0.00	0.0	0.00
TOTAL AREA =							4.395 in ²		12.68		42.8

TOTAL DEPTH =	5.040 in
CENTROID (Y) = SUM(AY)/SUM(AREA) =	2.885 in
C1 = Y =	2.885 in
C2 = DEPTH - Ybar =	2.155 in
I(total)= [SUM(AY^2)+SUM(Io)]-(AREA)(Y)^2 =	6.211 in ⁴
Sx1 = I/C1 =	2.15 in ³
Sx2 = I/C2 =	2.88 in ³
Radius of gyration (r) = (I/A)^1/2=	1.189 in

Modern Custom Fabrication, Inc.
 Fresno, California
 By: John F. Bradley, S.E.
 February 9, 2007

Customer: Siemens Water Technologies Corp.
 Location: Parker, Arizona
 Double Wall SS304 Carbon Filter Tank
 AWWA D100-05, IBC 2003

IBC Wind Design

IBC 2003 Wind Design Pressures

Per ASCE 7-02 Sect. 6.5.13

Lateral Wind Pressure: $P_{LAT} = q_z G C_f = 13.4 \text{ psf}$

Where: Velocity Pressure (q_z) = $0.00256 K_z K_{zt} K_d V^2 I = 21.29 \text{ psf}$

Height to Top of Structure (h) = 20.0 ft

Basic Wind Speed (V) = 90 mph (3-second gust)

Exposure = C

Importance Factor (I) = 1.15

$K_z = 0.94$

$K_{zt} = (1 + K_1 K_2 K_3)^2 = 1.0$

$K_1 = 1.0$

$K_2 = 1.0$

$K_3 = 1.0$

$K_d = 0.95$

Gust Effect Factor (G) = $0.925[(1 + 1.7 g_Q I_z Q)/(1 + 1.7 g_v I_z)] = 0.896$

$g_Q = 3.4$

$g_v = 3.4$

$I_z = c(33/z)^{1/8} = 0.228$

$c = 0.2$

$z = 15$

$Q = [1/(1 + 0.63[(B+h)/L_z]^{0.63})]^{1/2} = 0.945$

$B = 10.67 \text{ ft (tank dia)}$

$L_z = l(z/33)^{\epsilon} = 427$

$l = 500$

$\epsilon = 0.2$

Force Coefficient (C_f) = 0.70 for round tanks

Governing design lateral wind pressure:

	P_w	
Calculated using AWWA D100-05	18.0 psf	(see next sheet)
Calculated per IBC 2003	13.4 psf	

Governing wind pressure: **18.0 psf**

Modern Custom Fabrication, Inc.
Fresno, California
By: John F. Bradley, S.E.
February 9, 2007

Customer: Siemens Water Technologies Corp.
Location: Parker, Arizona
Double Wall SS304 Carbon Filter Tank
AWWA D100-05, IBC 2003

AWWA Wind Design

(ref AWWA D100-05 Sect. 3.1.4)

AWWA D100-05 Wind Design Pressures

Lateral Wind on Tank Shell:

$$\begin{aligned} \text{Maximum of: } q_z GC_{fs} &= 15.6 \text{ psf} \\ \text{or } 30C_{fs} &= 18.0 \text{ psf} \\ \therefore \text{Shell Wind Load } (P_{ws}) &= 18.0 \text{ psf} \end{aligned}$$

Lateral Wind on Cone Bottom:

$$\begin{aligned} \text{Maximum of: } q_z GC_{fr} &= 13.0 \text{ psf} \\ \text{or } 30C_{fr} &= 15.0 \text{ psf} \\ \therefore \text{Cone Bottom Wind Load } (P_{wr}) &= 15.0 \text{ psf} \end{aligned}$$

Where:

$$\begin{aligned} q_z &= 0.00256 K_z V^2 = 26.0 \text{ psf} \\ K_z &= 1.09 \\ I &= 1.15 \\ V &= 90 \text{ mph (3-sec gust)} \\ G &= 1.0 \\ C_{fs} &= 0.6 \\ C_{fr} &= 0.5 \end{aligned}$$

Wind Base Shear:

$$V_{wind} = 1.1[P_{ws}DH_{cyl} + P_{wr}A_{xr}] = 2.4 \text{ k}$$

$$\text{Where: } A_{xr} = 49.3 \text{ ft}^2$$

Wind OTM:

Overturning moment from wind pressure (conservatively ignore portion of tank above anchor bolt circle):

$$M_w = 1.1[(P_{ws})(DH_{cyl}^2/2) + (P_{wr})(A_{xr})(1/3H_{cone} + H'_{cyl})] = 7.9 \text{ ft-k}$$

$$\text{Where: } P_{ws} = 18.0 \text{ psf}$$

$$P_{wr} = 15.0 \text{ psf}$$

$$D = 10.7 \text{ ft}$$

$$H_{cyl} = 7.5 \text{ ft}$$

$$H'_{cyl} = 4.3 \text{ ft}$$

$$H_{cone} = 9.3 \text{ ft}$$

$$\text{Wind OTM stability check: } M_{resist} = (0.6)(W_t)(D/2) =$$

45 ft-k, Therefore tank is stable

$$\text{Where: } W_t =$$

14.0 k (empty tank weight less uplift due to int. pressure)

Required shell plate thickness to avoid intermediate shell girders:

$$t = (P_w h D^{1.5} / 10625000)^{0.4}$$

h = Distance from top of shell down to point under consideration

$$h' = \text{Max height of unstiff. shell} = (10625000 t_{avg}) / [(P_w)(D/t_{avg})^{1.5}] = 529.5 \text{ ft}$$

$$\text{Actual Unstiffened Shell Height} = 7.50 \text{ ft}$$

$$\text{Shell is stable up to max wind speed of} = 847 \text{ mph (sustained load)}$$

$$\text{or} = 1017 \text{ mph (3-second gust)}$$

Average thickness checks below are corroded thicknesses; thk req'd & thk used are uncorroded thicknesses.

"Min t req'd" takes into account excess material available in rings above to resist wind loads.

Required Shell Thickness

Ring No.	Ring Ht (inches)	Design Point from Top of Tank (h, ft)	Allow. Ht w/o Wind Girder (ft)	Req'd Avg. Thickness this Ht (in)	Actual Avg Thk this Ht (in)	Min t req'd [incl. c.a.] (in)	Thickness Used (in)
1	90	7.50	529.5	0.0455	0.2500	0.0455	0.2500

Modern Custom Fabrication, Inc.
 Fresno, California
 By: John F. Bradley, S.E.
 February 9, 2007

Customer: Siemens Water Technologies Corp.
 Location: Parker, Arizona
 Double Wall SS304 Carbon Filter Tank
 AWWA D100-05, IBC 2003

Natural Period of Vessel

Natural Period of Vessel:

The natural period of vibration for the vessel structure is calculated as though vessel is a pendulum fixed at anchor bolt circle (distributed mass cantilever). The mass is assumed to be distributed uniformly from the top to the bottom of the vessel. This is a conservative assumption and actual vessel period is shorter than that calculated below. These calculations consider vessel only and do not address support structure.

$$\delta = wL^4 / (8EI) = 0.00344 \text{ in}$$

Where: $w = 100 \text{ lbs/in}$ (virtual load)
 $L = 201 \text{ in}$

$$I = \pi(D_o^4 - D_i^4) / 64 = 204684 \text{ in}^4$$

$$K = w / \delta = 29093 \text{ lbs/in/in}$$

$$m = (W_{\text{empty}} / L) / g = 0.1812 \text{ lb-in/sec}^2$$

$$\text{Circular natural frequency} = \omega = (K/m)^{1/2} = 400.70 \text{ sec}^{-1}$$

$$\text{Natural frequency} = f = \omega / 2\pi = 63.77 \text{ Hz}$$

$$\text{Vessel natural period} = T = 1/f = 0.0157 \text{ sec}$$

Since period is less than 0.06 sec, Rigid Structure formula ASCE 7-02 Eq. 9.14.5.2 applies

Modern Custom Fabrication, Inc.
Fresno, California
By: John F. Bradley, S.E.
February 9, 2007

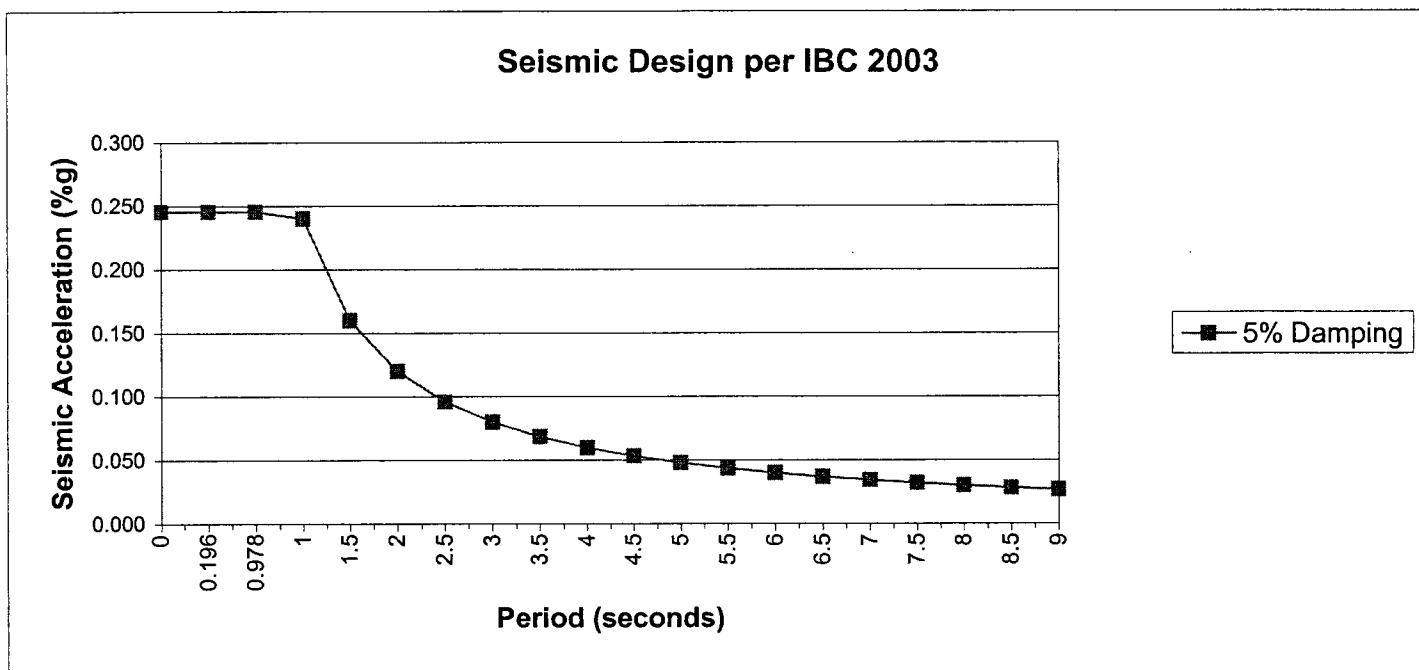
Customer: Siemens Water Technologies Corp.
Location: Parker, Arizona
Double Wall SS304 Carbon Filter Tank
AWWA D100-05, IBC 2003

IBC 2003 Seismic Design Acceleration Values

Spent Activated Carbon Slurry Vessel for Siemens Water Treatment Tech. Corp.
(General Procedure)

IBC 2003 Seismic Design Parameters

$S_s =$	0.230 g	$S_{DS} =$	0.245 g
$S_1 =$	0.150 g	$S_{D1} =$	0.240 g
$F_a =$	1.60	$T_O =$	0.196 sec
$F_v =$	2.40	$T_s =$	0.978 sec
$S_{MS} =$	0.368 g	S_{DS}	S_{D1}
$S_{M1} =$	0.360 g	5% damped	0.245 0.240



Tank Periods

Impulsive (T_i) = 0.0157 sec

IBC/ASCE 7-02 Design Values:

$$A_i = C_s = S_{DS} I_e / R = 0.123 \text{ g}$$

Where: Reduction Factor for Inelastic Design (R) = 3 (at anchorage of tank-to-supports)
 I_e = 1.5 (Seismic Use Group III)

Check min. req'd seismic impulsive accelerations:

ASCE 7-02 Eq 9.14.5.1-1:	$A_{i(min)} = 0.14 S_{DS} I_e =$	0.052 g < 0.123g -- Does not govern
Eq 9.14.5.1-2:	$A_{i(min)} = 0.8 S_1 I_e / R =$	0.060 g < 0.123g -- Does not govern
Eq 9.14.5.2:	$A_{i(min)} = 0.3 S_{DS} I_e =$	0.110 g < 0.123g -- Does not govern

IBC 2003: A_i (impulsive acceleration) = 0.123 g

Modern Custom Fabrication, Inc.
 Fresno, California
 By: John F. Bradley, S.E.
 February 9, 2007

Customer: Siemens Water Technologies Corp.
 Location: Parker, Arizona
 Double Wall SS304 Carbon Filter Tank
 AWWA D100-05, IBC 2003

IBC 2003 Seismic Design Loads

IBC 2003 Seismic Design Loads: (ref ASCE 7-02 Sect. 9.14 - Nonbuilding Structures)

Base Shear: (ref ASCE 7-02 Eq. 9.5.5.2-1)

Vessel full: $V_{s-full} = A_i W_{full} / 1.4 =$ **9.0 k** **GOVERNS**

Where: Design acceleration $= A_i = C_s =$ 0.123 g

$W_{full} =$ 102.5 k

Vessel empty: $V_{s-empty} = A_i W_{empty} / 1.4 =$ **1.2 k**

$W_{empty} =$ 14.0 k

Overturning Moments:

Vessel full: $M_{s-full} = (V_{s-full})(CG_{full}) =$ **35.9 ft-k** **GOVERNS**

Where: $CG_{full} =$ 4.0 ft

Vessel empty: $M_{s-empty} = (V_{s-empty})(CG_{empty}) =$ **6.9 ft-k**

Where: $CG_{empty} =$ 5.6 ft

Notes:

Centers of gravity are distances below bolt circle.

Roof, product, and shell above bolt circle are conservatively ignored in CG calculations.

Resisting Moments:

Vessel full: $M_{resist} = (0.6)(W_{full})(D/2) =$ **328 ft-k, Therefore tank is stable**

Vessel empty: $M_{resist} = (0.6)(W_{empty})(D/2) =$ **45 ft-k, Therefore tank is stable**

Modern Custom Fabrication, Inc.
 Fresno, California
 By: John F. Bradley, S.E.
 February 9, 2007

Customer: Siemens Water Technologies Corp.
 Location: Parker, Arizona
 Double Wall SS304 Carbon Filter Tank
 AWWA D100-05, IBC 2003

AWWA D100-05 Seismic Design Values

Tank Data
 D = 10.7 ft Tank diameter
 H = 16.75 ft Design liquid level

General Procedure Response Spectrum

$S_s = 0.230$ g Max spectral response acceleration @ short periods (from USGS maps)
 $S_1 = 0.150$ g Max spectral response acceleration @ 1-sec period (from USGS maps)
 Site Class = D Use Site Class D unless specified otherwise

Seismic Use Group: 3 Use Seismic Use Group III unless specified otherwise
 $I_E = 1.50$ Seismic importance factor

Is tank anchored? y $R_i = 3.0$ Response modification factor, impulsive component
 $R_c = 1.5$ Response modification factor, convective component

$F_a = 1.6$ Acceleration-based site coefficient
 $F_v = 2.2$ Velocity-based site coefficient

$S_{MS} = F_a S_s = 0.368$ g Max spectral acceleration @ short periods, adjusted for site class effects
 $S_{M1} = F_v S_1 = 0.330$ g Max spectral response acceleration @ 1-sec period, adjusted for site class effects

$S_{DS} = US_{MS} = 0.245$ g Design response spectra value for short periods
 $S_{D1} = US_{M1} = 0.220$ g Design response spectra value for 1-sec period
 $U = 0.667$ Scaling factor

Design response value for impulsive components:

$T_i = N/A (< T_s)$ Natural period of structure
 $T_L = 8.00$ Region-dependent transition period for longer period ground motion (check maps)
 $T_s = S_{D1}/S_{DS} = 0.897$ s
 $S_{ai} = S_{DS} = 0.245$ g

Design response value for convective components:

$T_c = 1.885$ s $= 2\pi\{D/[(3.68g)(\tanh(3.68H/D))]\}^{1/2}$

Design Accelerations

$A_i = S_{ai} I_E / 1.4 R_i = 0.088$ g
 $A_v = 0.14 S_{DS} = 0.034$ g ref Sect 13.3.3.6 or 13.5.4.3
 $A_{i(min)} = 0.36 S_1 I_E / R_i = 0.027$ g OK -- Doesn't govern

Freeboard

Group 3 $T_c < T_L$, d = 0.93 ft = $0.5 D A_f$ REQUIRED
 $A_f = K S_{D1} / T_c = 0.175$ g Convective design acceleration for sloshing
 $K = 1.5$

Modern Custom Fabrication, Inc.
 Fresno, California
 By: John F. Bradley, S.E.
 February 9, 2007

Customer: Siemens Water Technologies Corp.
 Location: Parker, Arizona
 Double Wall SS304 Carbon Filter Tank
 AWWA D100-05, IBC 2003

AWWA D100-05 Seismic Design Loads

Seismic Base Shear (Shear at anchor bolt circle)

$$V_{\text{actual}} = (A_i)(W_s + W_r + W_f + W_T) = \quad \quad \quad \mathbf{9.0 \text{ k}}$$

Where: $A_i =$ 0.088 g (impulsive acceleration)

$W_s =$ 7.0 k (wt of double tank shell)

$W_r =$ 2.6 k (wt of tank roof & weir)

$W_f =$ 4.4 k (wt of tank double cone bottom)

$W_T =$ 89 k (wt of tank contents)

Seismic Overturning Moment: (OTM at anchor bolt circle)

Conservatively ignore roof and tank contents above anchor bolt circle.

$$M_{\text{actual}} = (A_i)(W_s X_s + W_f X_f + W_T X_T) = \quad \quad \quad \mathbf{35.2 \text{ ft-k}}$$

Where: $X_s =$ 2.13 ft

$X_f =$ 7.33 ft

$X_T =$ 4.00 ft

Modern Custom Fabrication, Inc.
 Fresno, California
 By: John F. Bradley, S.E.
 February 9, 2007

Customer: Siemens Water Technologies Corp.
 Location: Parker, Arizona
 Double Wall SS304 Carbon Filter Tank
 AWWA D100-05, IBC 2003

Shell Tension Due to Wind & Seismic OTM per IBC 2003

(Load Combinations per IBC 2003, Allowable Stresses per AWWA)

Check Tension in Shell: Allowable Stress Design; gov. Load Combinations: 1) D + W
 (ref IBC 2003 Sect. 1605.3.1) 2) D + L + 0.7E

Check tank shell for tension due to OTM:

Critical case is at underside of anchor bolt circle due to rocking of tank.

Allowable tensile stress = $F_t = 15 \text{ ksi} \times 0.85 \times 1.33 = 17.0 \text{ ksi}$ for wind & seismic loading
 (ref AWWA D100-05, Sect 13.5.4.2.4)

Case 1: Wind OTM on empty tank

$$f_{tw} = (W_{\text{tank-empty}})/A + (M_w/S) = 0.17 \text{ ksi}$$

$$\text{Where: } A = \pi t(D_o - t_{\text{corr}}) = 100.3 \text{ in}^2$$

$$S = \pi(D_o^4 - D_{i(\text{corr})}^4)/(32D_o) = 3198 \text{ in}^3$$

$$M_w = 7.9 \text{ ft-k}$$

$$W_{\text{tank-empty}} = 14 \text{ k}$$

Since actual shell tensile stress < allowable, shell is OK for Case 1

Case 2: Seismic OTM on full tank

$$f_{ts} = (W_{\text{tank-full}})/A + (M_{s-\text{full}})/S = 1.16 \text{ ksi}$$

$$\text{Where: } M_s = 35.9 \text{ ft-k}$$

$$W_{\text{tank-full}} = 102.5 \text{ k}$$

Since actual shell tensile stress < allowable, shell is OK for Case 2

Therefore Shell is OK for Tensile Loads due to Wind or Seismic

Modern Custom Fabrication, Inc.
 Fresno, California
 By: John F. Bradley, S.E.
 February 9, 2007

Customer: Siemens Water Technologies Corp.
 Location: Parker, Arizona
 Double Wall SS304 Carbon Filter Tank
 AWWA D100-05, IBC 2003

Shell Compression Due to Wind & Seismic OTM per IBC 2003

(Loads & Load Combinations per IBC 2003, Allowable Stresses per AWWA D100-05)

Check Compression in Shell:

Allowable Stress Design; gov. Load Combinations: 1) D + W
 (ref IBC 2003 Sect. 1605.3.1) 2) D + L + 0.7E

Check tank shell for compression due to OTM:

Critical case is at top side of anchor bolt ring due to rocking of tank.

Allowable Stress:

Material = SS304 $F_a = 8.65 \text{ ksi} \times 1.33 = 10.38 \text{ ksi}$ for A36, wind & seismic loading
 (ref AWWA 13.5.4.2.4)

Actual Stresses:

Wind:	$f_{cw} = (W_{\text{upper tank}})/A + M_w/S =$	0.089 ksi	< F_a - Shell is OK
Seismic:	$f_{cs} = (W_{\text{upper tank}})/A + M_s/S =$	0.195 ksi	< F_a - Shell is OK
	Where: $M_w =$	7.9 ft-k	
	$M_s =$	35.9 ft-k	

Therefore Shell is OK for Wind & Seismic Overturning Compressive Loads

Modern Custom Fabrication, Inc.
 Fresno, California
 By: John F. Bradley, S.E.
 February 9, 2007

Customer: Siemens Water Technologies Corp.
 Location: Parker, Arizona
 Double Wall SS304 Carbon Filter Tank
 AWWA D100-05, IBC 2003

Stiffened Roof Design

Roof consists of 3/16" flat plate with L4x4x3/8 angles formed from SS304 plate.
 Maximum actual stiffener spacing = 4'-0" o.c. Max allowable spacing = 7'-0" o.c. per
 AWWA D100-05 Sect. 3.6.1.7.

Roof Live Load (L) =	25 psf
Roof Plate Dead Load (D) =	8.42 psf
Self weight of angle (D) =	10.8 plf
Extra point load at center (P) =	200 lbs (nozzle, hatch, etc)
Length of stiffener (L_{rafter}) =	9.25 ft

Allowable Bending Stress

Allowable bending stress (F_b) = **15000 psi** (ref. AWWA D100-05 Table 7, Class 1 material)

Actual Bending Stresses

Case 1: D + L

Allowable Stress Design; gov. Load Combination: 1) D + L (ref IBC 2003 Sect. 1605.3.1)

$$\text{Maximum bending moment} = w_{(D+L)} L_{\text{rafter}}^2 / 8 + PL_{\text{rafter}} / 4 = 2008 \text{ ft-lbs}$$

$$\text{Where: } w_{(D+L)} = 144 \text{ plf}$$

$$\text{Actual bending stress } (f_b) = M/S = \mathbf{4678 \text{ psi -- OK}}$$

$$\text{Where: } S = 5.15 \text{ in}^3 \quad (\text{see sheet following})$$

Case 2: D + Ponding on Roof

(Two 3/4" dia holes are drilled near bottom center sections of L4x4x3/8 rafters to prevent rain accumulation in 4' square center section of roof)

$$\text{Actual rafter deflection per above loads} = 0.072 \text{ in}$$

$$\text{Conservatively assume 1" of water on roof} = 5.20 \text{ psf}$$

$$\text{Maximum bending moment} = w_{(D+Ponding)} L_{\text{rafter}}^2 / 8 + PL_{\text{rafter}} / 4 = 1161 \text{ ft-lbs}$$

$$\text{Where: } w_{(D+Ponding)} = 65 \text{ plf}$$

$$\text{Actual bending stress } (f_b) = M/S = \mathbf{2705 \text{ psi -- OK}}$$

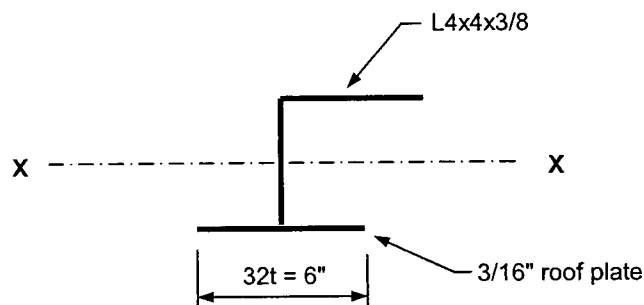
Since actual bending stress is less than allowable, roof & stiffeners are OK

Modern Custom Fabrication, Inc.
 Fresno, California
 By: John F. Bradley, S.E.
 February 9, 2007

Customer: Siemens Water Technologies Corp.
 Location: Parker, Arizona
 Double Wall SS304 Carbon Filter Tank
 AWWA D100-05, IBC 2003

Section Properties of Composite Roof Stiffener

Section Properties of Stiffened Roof Section



	Previous Area	b	d	Theta	a	h	AREA	Y	AY	AY ²	Io
1	-	6	0.1875	0	0.000	0.188	1.125	0.094	0.11	0.0	0.00
2	1	0.375	3.625	0	0.188	3.813	1.359	2.000	2.72	5.4	1.49
3	2	4	0.375	0	3.813	4.188	1.500	4.000	6.00	24.0	0.02
4	3	0	0	0	4.188	4.188	0.000	4.188	0.00	0.0	0.00
5	4	0	0	0	4.188	4.188	0.000	4.188	0.00	0.0	0.00
6	5	0	0	0	4.188	4.188	0.000	4.188	0.00	0.0	0.00
7	6	0	0	0	4.188	4.188	0.000	4.188	0.00	0.0	0.00
8	7	0	0	0	4.188	4.188	0.000	4.188	0.00	0.0	0.00
9	8	0	0	0	4.188	4.188	0.000	4.188	0.00	0.0	0.00
10	9	0	0	0	4.188	4.188	0.000	4.188	0.00	0.0	0.00
TOTAL AREA =							3.984 in ²		8.82		31.0

TOTAL DEPTH = 4.188 in
 CENTROID (Y) = SUM(AY)/SUM(AREA) = 2.215 in
 C1 = Y = 2.215 in
 C2 = DEPTH - Ybar = 1.973 in

I(total) = [SUM(AY²) + SUM(Io)] - (AREA)(Y)² = 11.41 in⁴
 Sx1 = I/C1 = 5.15 in³
 Sx2 = I/C2 = 5.79 in³
 Radius of gyration (r) = (I/A)^{1/2} = 1.693 in

Modern Custom Fabrication, Inc.
 Fresno, California
 By: John F. Bradley, S.E.
 February 7, 2007

Customer: Siemens Water Technologies Corp.
 Location: Parker, Arizona
 Double Wall SS304 Carbon Filter Tank
 AWWA D100-05, IBC 2003

Anchor Ring Design

Analysis of Bracket Load on Cylindrical Tank

Case 1: D + L

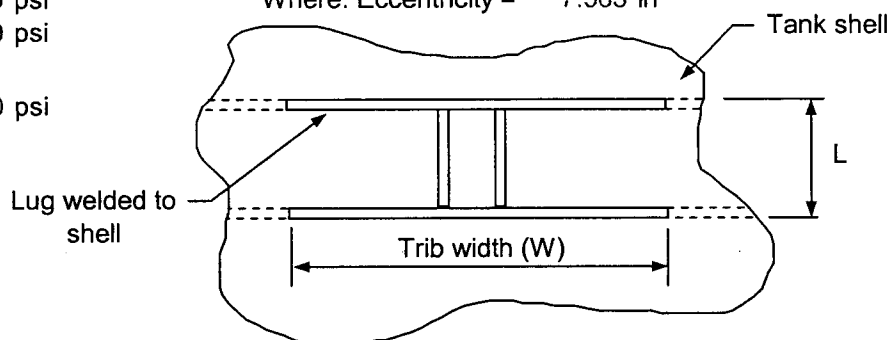
(Consider continuous anchorage ring as eight shell brackets of equivalent tributary width)

Tank Shell - Material & Dimensions

Tank Radius (R) =	64 in
Shell Thickness (t) =	0.250 in
Longitudinal Stress (S_L) =	50 psi
Hoop Stress (S_H) =	400 psi
Allowable Stress (S_m) =	12750 psi
Yield Stress (F_y) =	30000 psi
Allowable Stress Increase (k) =	1.00
Tensile Stress =	75000 psi

Shell Bracket - Dimensions & Loads

Bracket Width (W) =	50.3 in (= 1/8 tank circ)
Bracket Length (L) =	12.75 in
Longitudinal Moment (M) =	95666 in-lbs = $(W_{full})(eccent)/8$
Radial Load (Q) =	0 lbs
Where: Eccentricity =	7.563 in



Allowable Loads

Max. allowable loading limiting longitudinal stress to $0.75F_y$:

$$M_1 = (0.035WkF_y t^2)[6 + 6\beta L + (\beta L)^2] = 156200 \text{ in-lbs}$$

$$Q_1 = (0.208WkF_y t^2 \beta)(2 + \beta L) = 38390 \text{ lbs}$$

$$\text{Where: } \beta = 1.285/(Rt)^{1/2} = 0.3213$$

Max. allowable loading limiting circumferential stress to $0.75F_y$:

$$M_2 = (0.063WkF_y t^2)[6 + 6\beta L + (\beta L)^2] = 281160 \text{ in-lbs}$$

$$Q_2 = (0.379WkF_y t^2 \beta)(2 + \beta L) = 69951 \text{ lbs}$$

Unity Checks

- 1) $M/M_1 + Q/Q_1 = 0.612 < 1.0 \text{ OK!}$
- 2) $M/M_2 + Q/Q_2 = 0.340 < 1.0 \text{ OK!}$
- 3) $(M/M_1 + Q/Q_1)(0.75F_y)(k) + S_L = 13830 \text{ (psi)} < 3 S_m \text{ OK!}$
- 4) $(M/M_1)(0.75F_y)(k) + S_L = 13830 \text{ (psi)} < 1.5 k S_m \text{ OK!}$
- 5) $(M/M_2 + Q/Q_2)(0.75F_y)(k) + S_L = 8056 \text{ (psi)} < 3 S_m \text{ OK!}$
- 6) $(M/M_2)(0.75F_y)(k) + S_L = 8056 \text{ (psi)} < 1.5 k S_m \text{ OK!}$

Where:

$$3 S_m = 38250 \text{ (psi) but not greater than } 75000 \text{ (psi)}$$

$$1.5 k S_m = 19125 \text{ (psi)}$$

Therefore Anchor Bracket is OK for Case 1: D + L

Modern Custom Fabrication, Inc.
Fresno, California
By: John F. Bradley, S.E.
February 7, 2007

Customer: Siemens Water Technologies Corp.
Location: Parker, Arizona
Double Wall SS304 Carbon Filter Tank
AWWA D100-05, IBC 2003

Anchor Ring Design, cont

Analysis of Bracket Load on Cylindrical Tank

Case 2: D + L + 0.7E

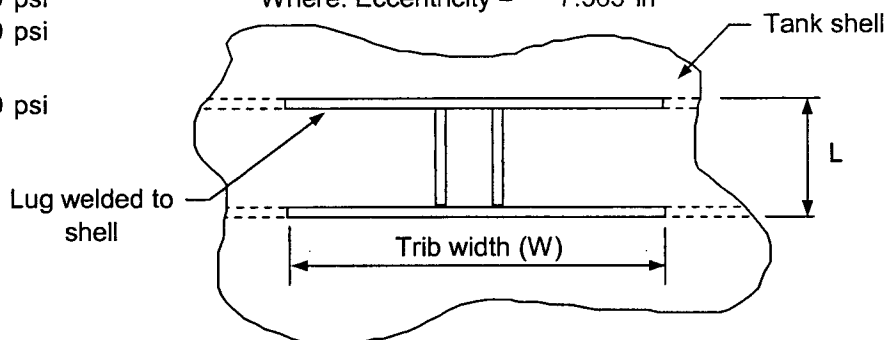
(Consider continuous anchorage ring as eight shell brackets of equivalent tributary width)

Tank Shell - Material & Dimensions

Tank Radius (R) =	64 in
Shell Thickness (t) =	0.250 in
Longitudinal Stress (S_L) =	1200 psi
Hoop Stress (S_H) =	400 psi
Allowable Stress (S_m) =	12750 psi
Yield Stress (F_y) =	30000 psi
Allowable Stress Increase (k) =	1.33
Tensile Stress =	75000 psi

Shell Bracket - Dimensions & Loads

Bracket Width (W) =	50.3 in (= 1/8 tank circ)
Bracket Length (L) =	12.75 in
Longitudinal Moment (M) =	106666 in-lbs = (D+L+0.7E)(eccent)
Radial Load (Q) =	0 lbs
Where: Eccentricity =	7.563 in



Allowable Loads

Max. allowable loading limiting longitudinal stress to $0.75F_y$:

$$M_1 = (0.035WkF_y t^2)[6+6\beta L+(\beta L)^2] = 207746 \text{ in-lbs}$$

$$Q_1 = (0.208WkF_y t^2 \beta)(2+\beta L) = 51059 \text{ lbs}$$

$$\text{Where: } \beta = 1.285/(Rt)^{1/2} = 0.3213$$

Max. allowable loading limiting circumferential stress to $0.75F_y$:

$$M_2 = (0.063WkF_y t^2)[6+6\beta L+(\beta L)^2] = 373942 \text{ in-lbs}$$

$$Q_2 = (0.379WkF_y t^2 \beta)(2+\beta L) = 93035 \text{ lbs}$$

Unity Checks

- 1) $M/M_1 + Q/Q_1 = 0.513 < 1.0 \text{ OK!}$
- 2) $M/M_2 + Q/Q_2 = 0.285 < 1.0 \text{ OK!}$
- 3) $(M/M_1 + Q/Q_1)(0.75F_y)(k) + S_L = 16565 \text{ (psi)} < 3 S_m \text{ OK!}$
- 4) $(M/M_1)(0.75F_y)(k) + S_L = 16565 \text{ (psi)} < 1.5 k S_m \text{ OK!}$
- 5) $(M/M_2 + Q/Q_2)(0.75F_y)(k) + S_L = 8936 \text{ (psi)} < 3 S_m \text{ OK!}$
- 6) $(M/M_2)(0.75F_y)(k) + S_L = 8936 \text{ (psi)} < 1.5 k S_m \text{ OK!}$

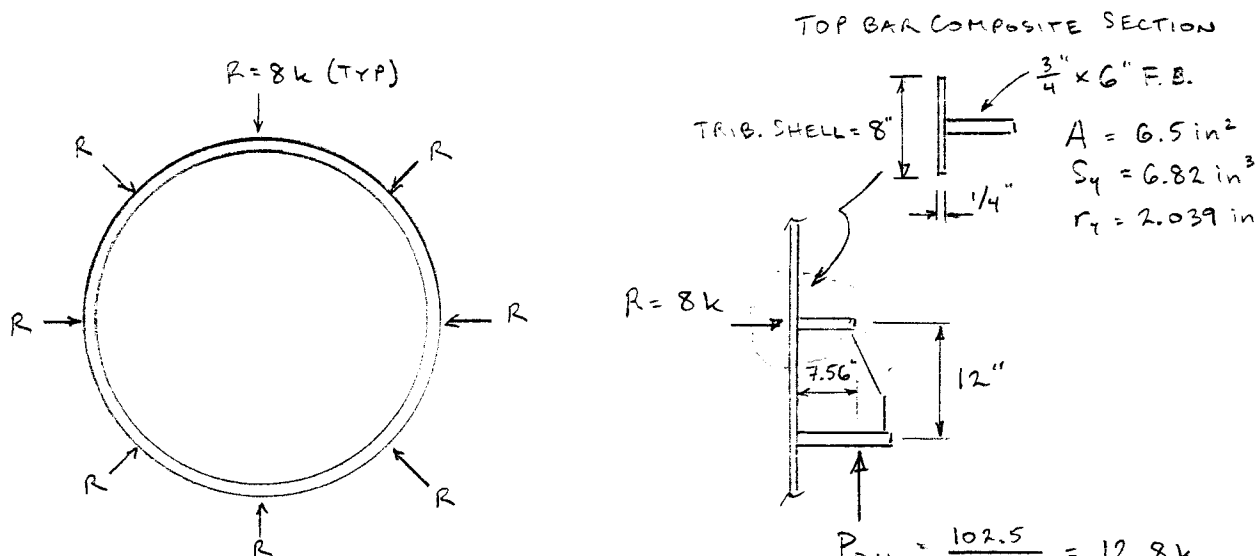
Where:

$$\begin{aligned} 3 S_m &= 38250 \text{ (psi) but not greater than } 75000 \text{ (psi)} \\ 1.5 k S_m &= 25436 \text{ (psi)} \end{aligned}$$

Therefore Anchor Bracket is OK for Case 2: D + L + 0.7E

ANCHOR RING, CONT.

CHECK TOP \overline{P}_2 AS CONTINUOUS RING GIRDER
SUBJECT TO (8) EQUIVALENT RADIAL POINT LOADS.



$$\left[\text{REF. ONLY - SEISMIC CASE DOESN'T GOVERN: } P_{\text{seis}} = \frac{4M}{nd} = \frac{4(50.3)}{(8)(11.96')} = 2.1 \text{ k} \right]$$

$$\begin{aligned} \text{MAX STRESS DUE TO THRUST/AXIAL LOAD} &= \frac{R}{A} \\ &= \frac{(1.207)(8\text{k})}{6.5 \text{ in}^2} \\ &= 1.49 \text{ ksi} \end{aligned}$$

$$\begin{aligned} \text{MAX STRESS DUE TO BENDING} &= \frac{M}{S} = \frac{(0.066)(8\text{k})(64'')}{6.82 \text{ in}^3} \\ (\text{@ PT. OF LOAD}) & \\ &= 4.95 \text{ ksi} \end{aligned}$$

ALLOWABLE STRESSES:

$$KR/r = \frac{50.3''}{2.039'} = 25 \rightarrow F_a = 15 \text{ ksi}$$

$$F_b = 15 \text{ ksi (AWWA D100-05 TABLE 7)}$$

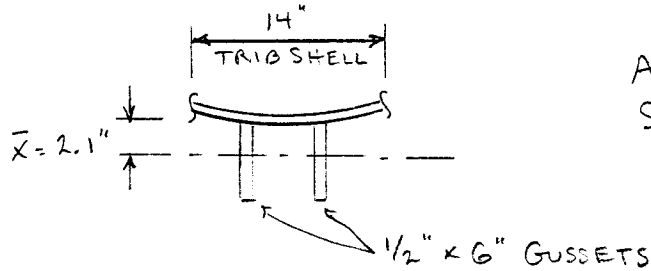
UNITY CHECK:

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} = \frac{1.49 + 4.95}{15} = 0.43 < 1.0 \checkmark \text{OK}$$

\therefore TOP \overline{P}_2 IS OK FOR BENDING + THRUST DUE 8 EQUAL
RADIAL LOADS AT ANCHOR CHAIRS

ANCHOR RING, CONT

CHECK BUCKLING OF GUSSET PLATES:



$$A_x = 9.5 \text{ in}^2$$

$$S_x = 9.54 \text{ in}^3$$

$$r = 2.04 \text{ in}$$

$$\text{AXIAL STRESS} = \frac{P}{A} = \frac{12.8 \text{ k}}{9.5 \text{ in}^2} = 1.4 \text{ ksi}$$

$$\text{BENDING STRESS} = \frac{M}{S_x} = \frac{(12.8 \text{ k})(7.56'' - 2.1'')}{9.54 \text{ in}^3} = 7.3 \text{ ksi}$$

ALLOWABLE STRESSES:

$$\frac{KL}{r} = \frac{12''}{2.04''} = 6 \rightarrow F_a = 15 \text{ ksi}$$

$$F_b = 15 \text{ ksi (AWWA D100-05, TABLE 7)}$$

UNITY CHECK:

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} = \frac{1.4 + 7.3}{15} = 0.58 < 1.0 \text{ } \checkmark \text{ OK}$$

 \therefore GUSSET PLATES IN ANCHOR RING ARE OK

Required Reinforcement @ Shell Penetration

Tank	
Tank Inside Diameter =	10.67 ft
Max liquid level in tank =	16.75 ft
Does hydrostatic load govern?	yes

Shell	
Shell Plate Material =	SS304
Allowable Stress =	15000 psi
Actual Shell Thickness @ Cutout =	0.25 in
Required Shell Thk @ Base of Ring =	0.025 in
Corrosion Allowance =	0 in

Nozzle

Nozzle Description =	6" Weir Nozzle		
Type (manway = "M" or pipe = "P"):	p		
Outside Dia of Pipe =	6.625 in		
Nozzle elevation (above tank bott) =	195 in		
Nozzle Material =	SS304		
Allowable Stress =	15000 psi		
Corroded nozzle neck thickness =	0.28 in	Thickness to eliminate repad =	0 "
Design thk (reduced for underruns) =	0.2450 in		
Length of nozzle neck =	9.25 in		
Inside projection =	0 in		
Outside projection =	9 in	Use 0.98 in. = max allowed	

Design

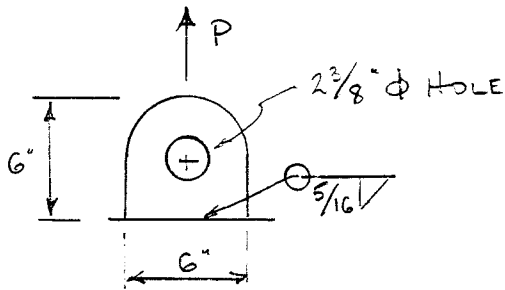
Method: Replace cross-sectional cutout area based on gross (g) or required (r) shell thickness? r		
Required Shell Plate Area Cutout =	0.16 in ²	Replace this cutout area with an equal amount of steel In the nozzle neck, excess shell plate, or repad per AWWA (ref AWWA Sect. 3.13).
Excess shell area available =	1.49 in ²	
Nozzle neck area available =	0.60 in ²	
Total =	<u>2.10 in²</u>	
Area to be provided by repad =	0.00	Repad Not Req'd

No Reinforcing Plate Required -- Sufficient Reinforcement Provided in Other Areas

Since nozzles in cone bottom are 4" or less, no additional reinforcing req'd per AWWA D100-05 Section 3.13

Drafting

Weld of nozzle to shell =	1/4 " (min)
---------------------------	-------------

LIFT LUGS ($\frac{1}{2}" \text{ PL}$)

$$\text{ACTUAL LOAD PER LUG} = \frac{14k}{4} = 3.5 k/\text{LUG}$$

DESIGN FOR LIFT w/ FACTOR OF SAFETY = 5.0

LUG

CHECK ACTUAL VS. ASD ALLOWABLE:

$$f_v = \frac{3.5k}{(\frac{1}{2}")(1.81")} = 3.9 \text{ ksi} < F_v = 0.4(30) = 12 \text{ ksi}$$

✓OK

CHECK LOAD \times F.O.S. VS. YIELD:

$$f_v' = \frac{(3.5k)(5)}{(\frac{1}{2}")(1.81")} = 19.3 \text{ ksi} < F_y = 30 \text{ ksi}$$

✓OK

ATTACHMENT WELD

$$\text{STRESS IN WELD} = \frac{(3.5k)(5)}{(\frac{5}{16}")(0.707)(13")} = 6.1 \text{ ksi} \quad \text{✓OK}$$

\therefore LIFT LUGS & ATTACHMENT WELDS ARE OK. ✓

Modern Custom Fabrication, Inc.
 Fresno, California
 By: John F. Bradley, S.E.
 February 9, 2007

Customer: Siemens Water Technologies Corp.
 Location: Parker, Arizona
 Double Wall SS304 Carbon Filter Tank
 AWWA D100-05, IBC 2003

Support Structure Design Loads

Design Criteria:

Tank Outside Diameter =	10.67 ft
Maximum Product & Hydrotest Height =	16.50 ft
Product Specific Gravity =	1.50
Roof Live Load =	25 psf

Shear at Anchor Bolt Circle:

Wind =	2.4 k
Seismic =	9.0 k

Overturning Moments at Anchor Bolt Circle:

Wind Overturning Design Moment (Tank Empty) =	7.9 ft-k
Seismic Overturning Design Moment (Tank Full) =	35.9 ft-k

Weights of Tank & Contents:

Weight of Empty Tank =	14 k	↓
Total Weight of Product in Full Inner Tank =	83 k	↓
Total Weight of Product in Full Inner + Outer Tank =	89 k	↓
Total Weight of Tank + Inner Shell Full of Product =	97 k	↓
Total Weight of Tank + Inner & Outer Shells Full of Product =	103 k	↓
Weight of Water in Tank =	59 k	↓

Anchor Bolt Design Loads:

Use (8) Anchor Bolts Around (Design by Others)

Max Uplift due to Seismic OTM on Full Tank =	1.7 k/bolt	↑
Max Uplift due to Wind OTM =	0.4 k/bolt	↑
Max Shear due to Seismic Loads =	1.1 k/bolt	
Max Shear due to Wind Loads =	0.3 k/bolt	
Tank Dead Load Resisting Uplift =	1.8 k/bolt	↓
Tank + Inner Shell Full of Product Load Resisting Seismic Uplift =	12.1 k/bolt	↓

Notes:

- 1) Above loads are unfactored, service level design loads.
- 2) Weights of tank contents above consider tank as full to top of shell.

Exhibit B - Design Standards

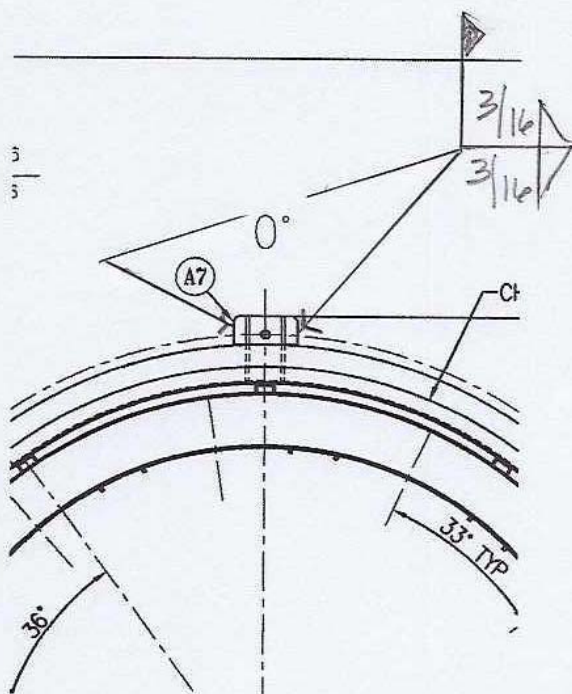
Structural Calculations for T-18 Support Steel

DESIGNED BY CD DATE 2/26/07
CHECKED BY _____ DATE _____

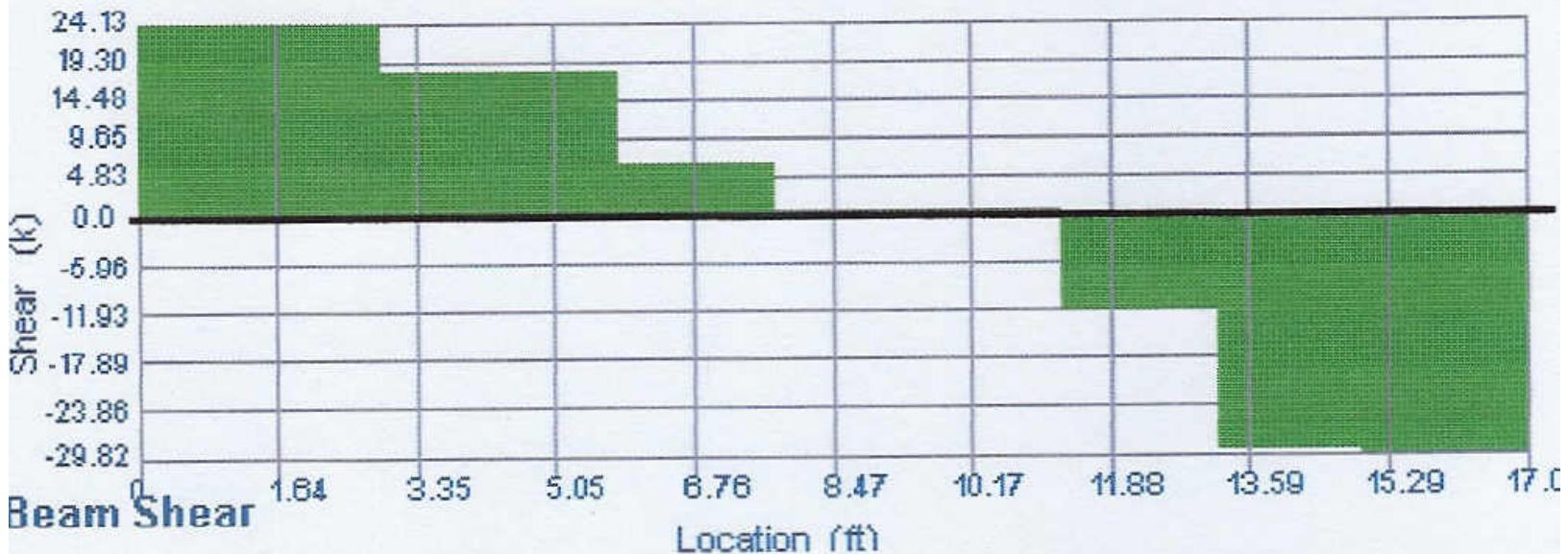
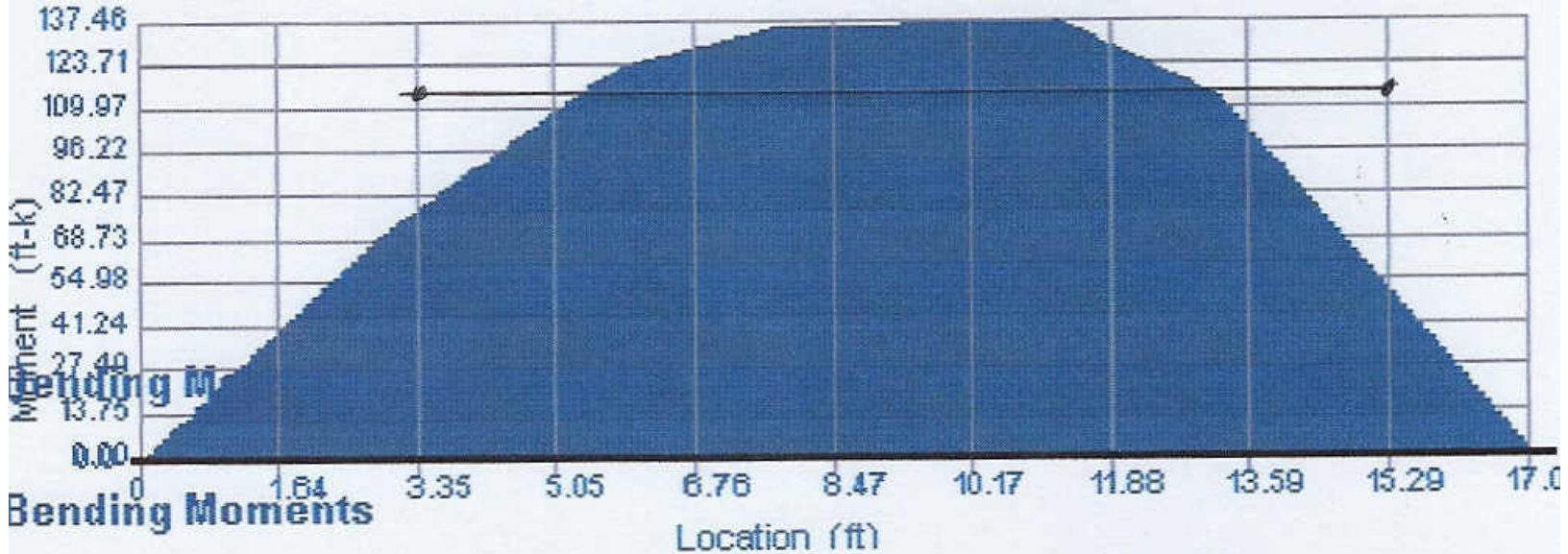
CLIENT: SIEMENS WATER TECHNOLOGIES

C.D.S.E.

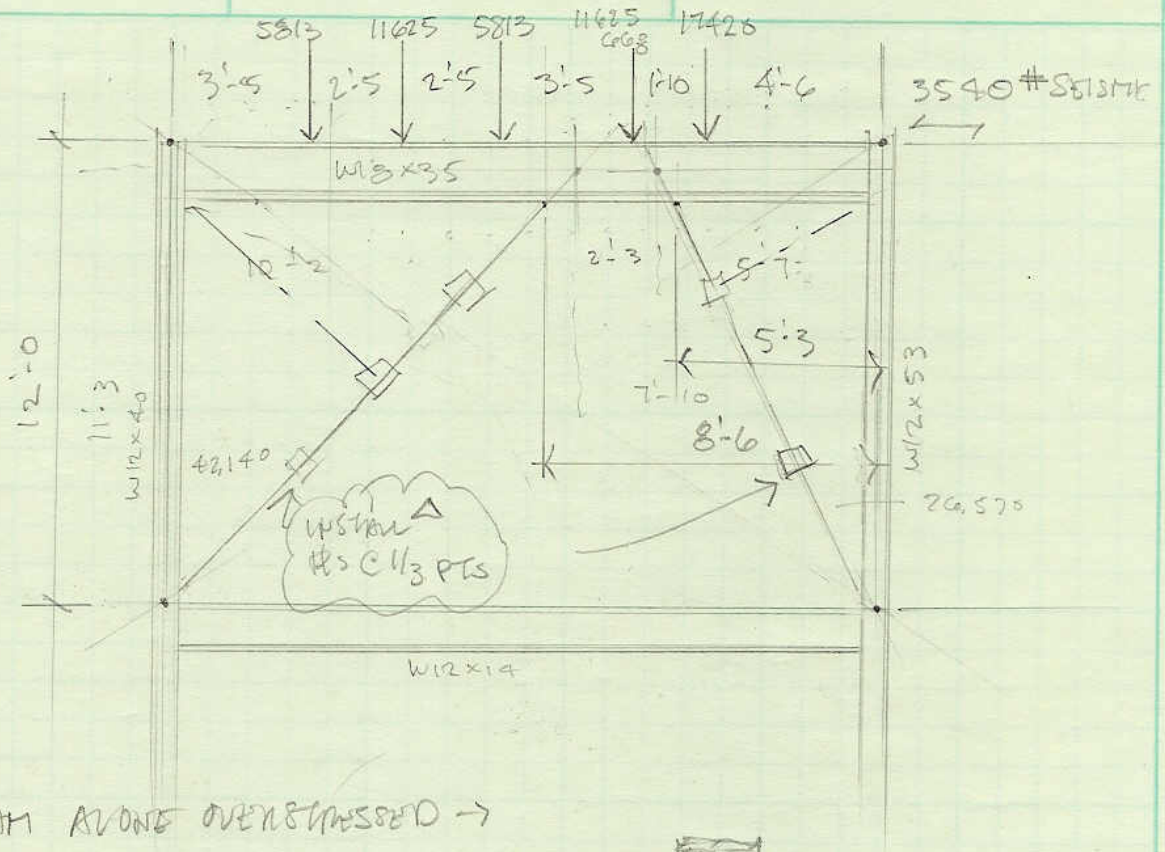
CHARLES J. DOELL, P.E.
CONSULTING STRUCTURAL ENGINEER



PLAN OF TANK LUG



BCB
W18x35
L=18'



BEAM ABOVE OVERSTRESSED \rightarrow

$$M = 141.7 \text{ k} \quad 137.5$$

$$M_a = 57.6(2) = 115.2 \text{ k}$$

$$\Delta M = 22.3 \text{ k}$$

$$S = 11.2 = \frac{I}{8.85}$$

$$I = 98.7 \text{ in}^4 = 2A(4.5)^2 \quad A = 2.44 \text{ in}^2$$

BAR $1\frac{1}{2} \text{ } \phi \times 15' \text{ L} 4' \text{ CENTER BETW COLUMNS}$

- 1) Reinforce Beam with BAR $1\frac{1}{2} \text{ } \phi$
- 2) STRENGTHEN PILES WITH SECONDARY

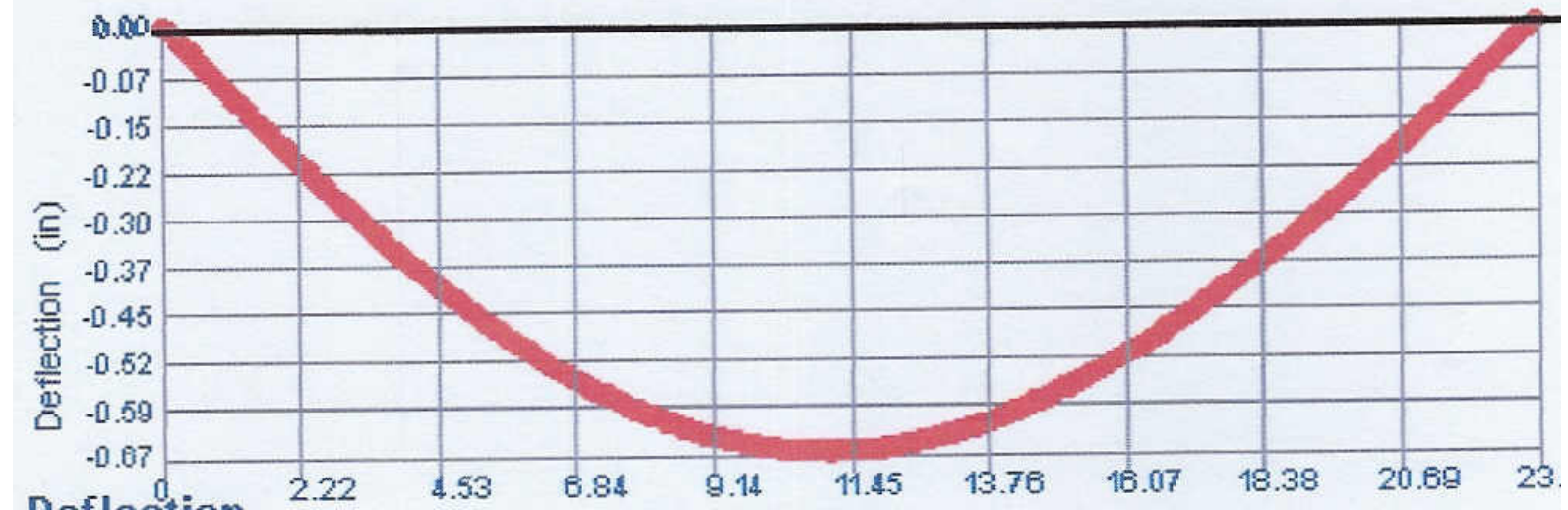
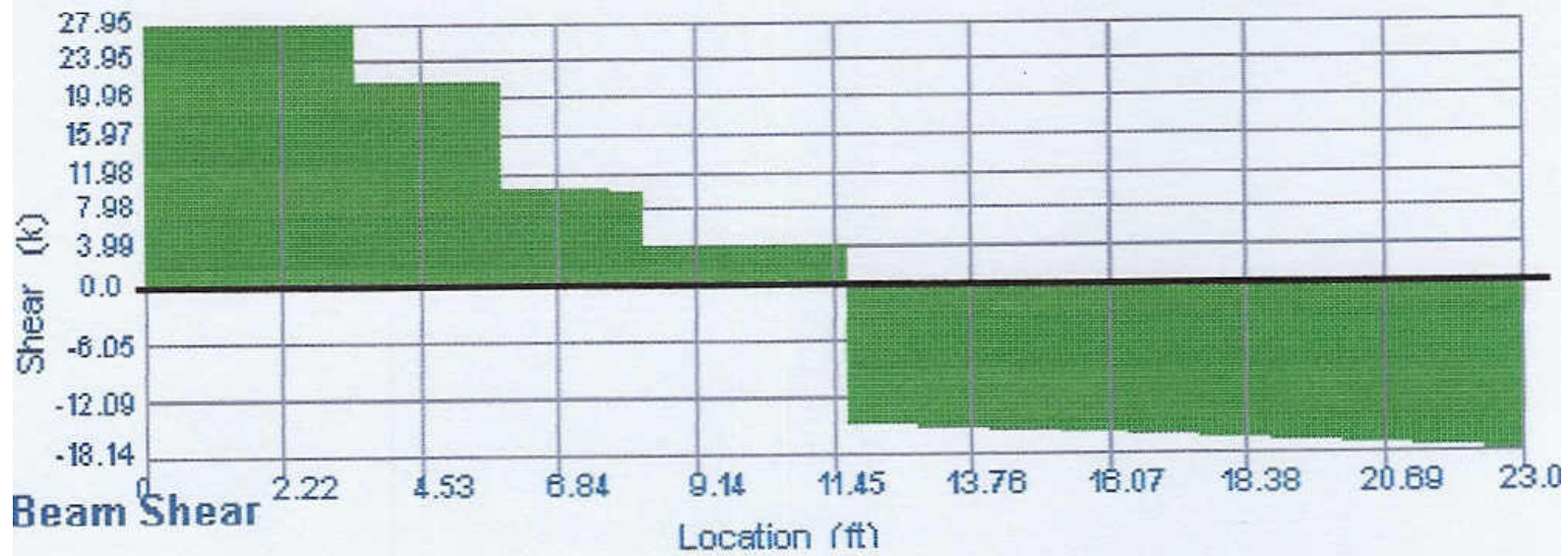
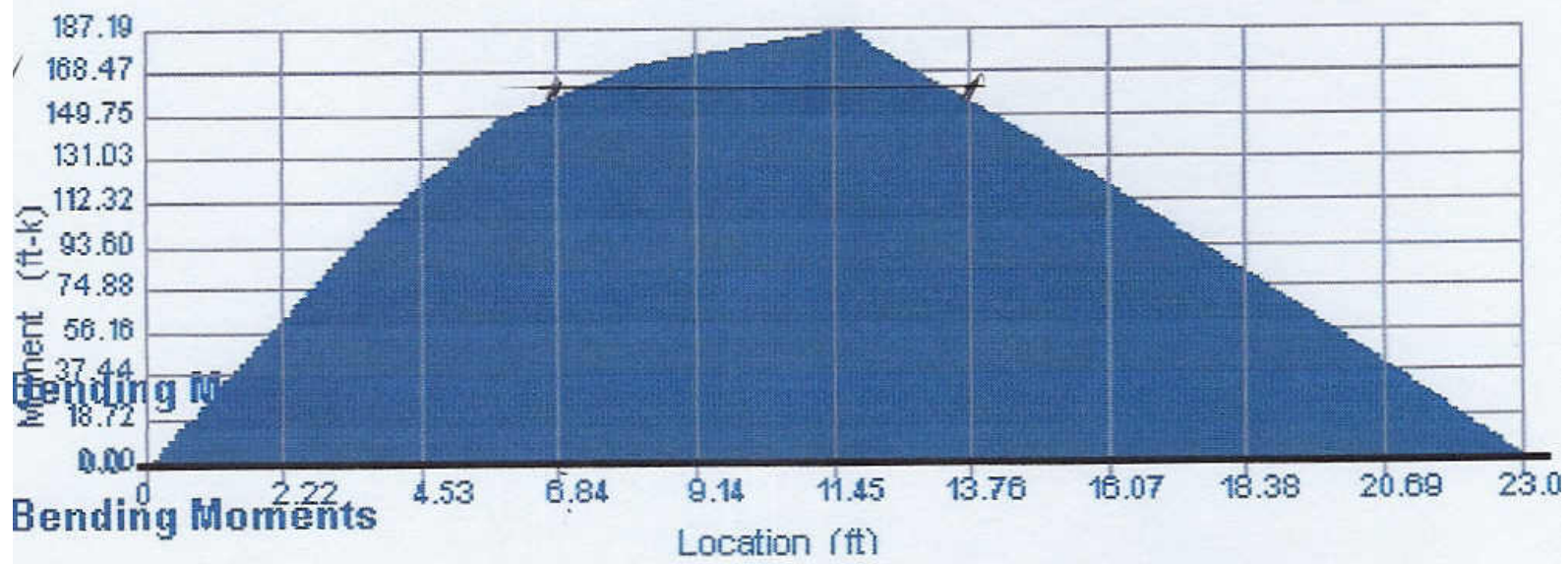
$$I = 510 + 2(2.25)(4.5)^2 = 601.4 \text{ in}^4$$

$$f_b = \frac{137.5(12)(8.85)}{601} = 24.3 \text{ ksi} \quad \text{OK}$$

$$f_{b_{\text{BAR}}} = \frac{137.5(12)(5.85)}{601} = 14.4 \text{ ksi}$$

$$F = 32.4 \text{ k} / \frac{2(.3)(14.4)}{2(1.928)(3)} = 4" \quad 5.0" - 6"$$

12" GA FWD

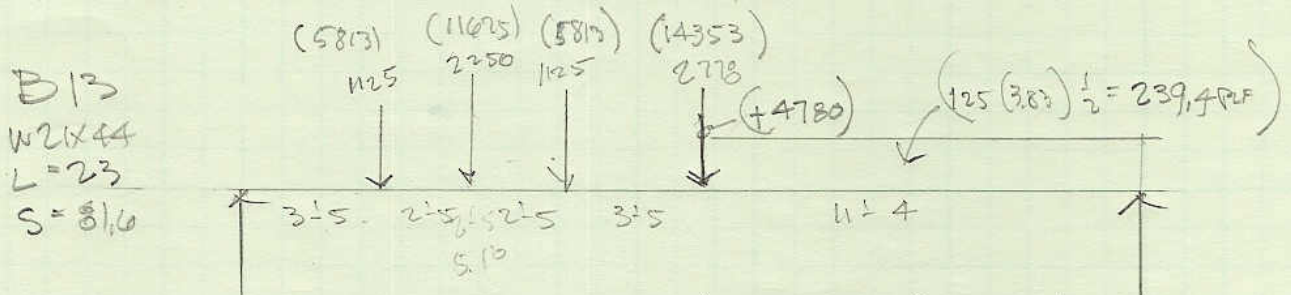


$$\text{CHECK } M = 25283(11.17) - 125(11.17)^2 - 5813(8.25) - 11626(5.83) - 5813(3.42) = 138996$$

$$f_b = \frac{138996(12)}{57.6} = 28957 \text{ psi} > 24000$$

$\therefore 1.66 f_y \quad F_y \rightarrow 43875$

\therefore Reinforce - use WT 9 x 17.5



$$\Delta R = 2778(11.33) + 1125 \left(\frac{14.75}{23} \right) + 2250 \left(\frac{17.17}{23} \right) + 1125 \left(\frac{19.58}{23} \right)$$

$$= 4727 \#$$

$$\Delta M = 4727(11.67) - 1125(3.42) - 2250 \left(\frac{5.93}{23} \right) - 1125(8.25)$$

$$= 28918 \# \cdot \text{ft}$$

$$f_b = \frac{28918(12)}{81.6} = 4253 \text{ psi} \quad (+17.2\%)$$



$$R_L = 4727 \left(\frac{11.625}{2250} \right) + \frac{4720(11.33) + 239.4(11.33) 5.67}{23}$$

$$= 24423 + 3023 = 27446 \#$$

$$R_u = 17650 \#$$

$$M = 27446(11.67) - 5813(3.42) - 11625(5.83) - 5813(8.25)$$

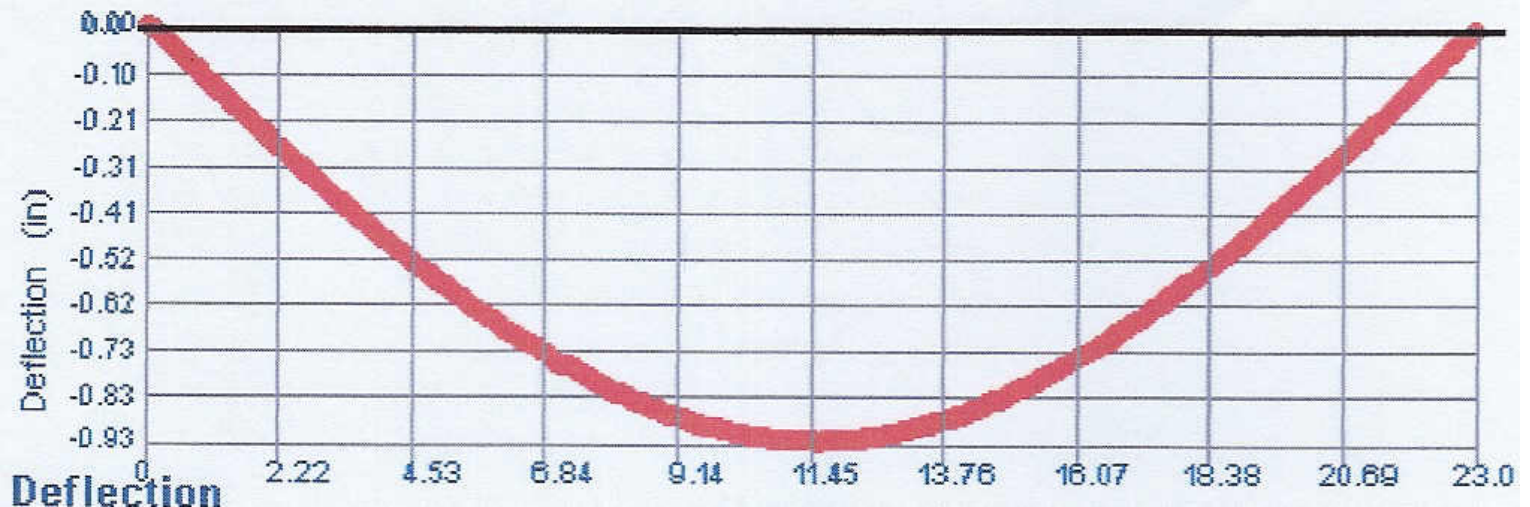
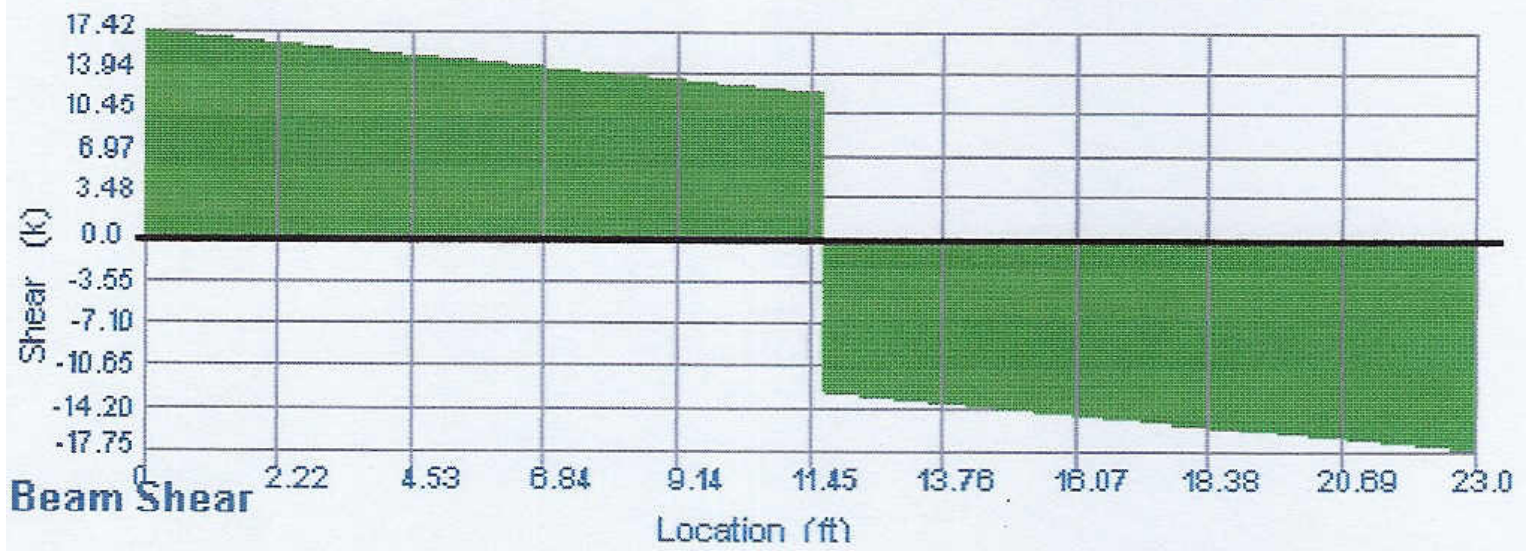
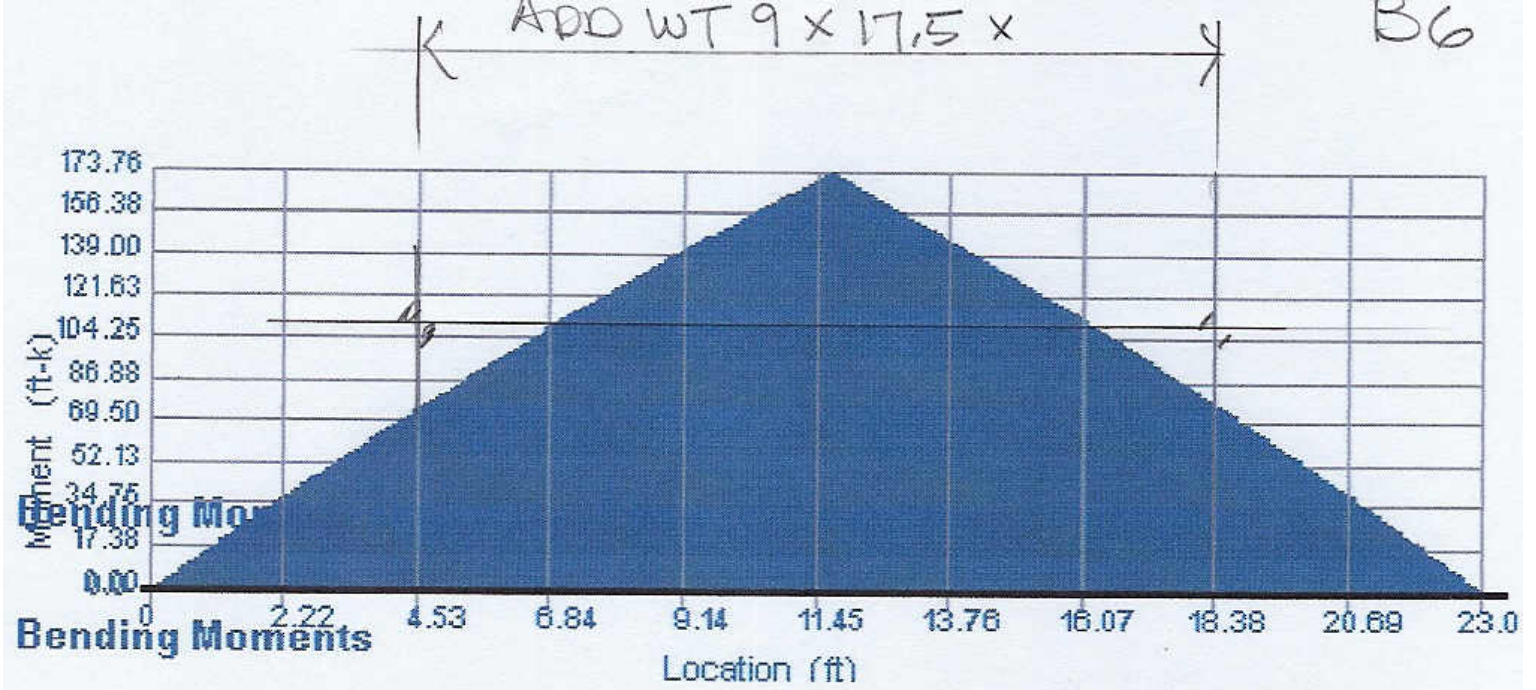
$$= 184683 \# \cdot \text{ft}$$

$$\text{CHECK } M = 17650(11.33) - 239.4(11.33) \frac{1}{2} = 184608$$

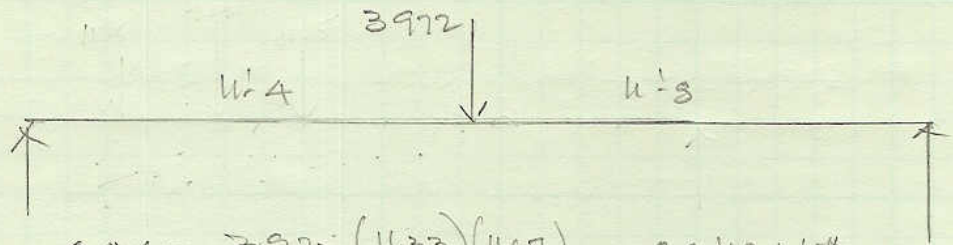
$$f_b = \frac{184683(12)}{81.6} = 27148 \text{ psi} \quad (+13\%)$$

$\therefore 1.66 f_y + F_y = 41333 \text{ psi}$

\therefore REINFORCE PER ABOVE



BL
W18x35
L=23'
S=57.6



$$\Delta M = \frac{3972(11.33)(11.67)}{23} = 22834 \text{ lb-ft}$$

$$\Delta f_b = \frac{22834(12)}{57.6} = 4757 \text{ psi } (+198\%)$$

$$M = \frac{11625}{2250} (22834) + 125 \left(\frac{4.5+1.83}{2} \right) 232$$

118 lb-ft 24.2

TANK LOCAL CRACK

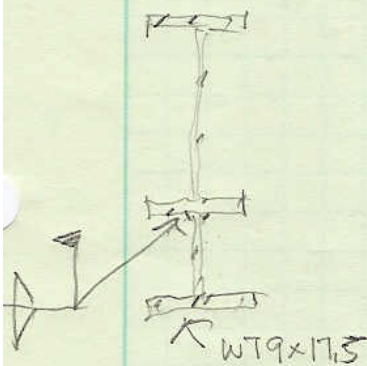
$$+ 125(11.33) \frac{1}{2} (13.5) \frac{1}{2} \left(\frac{11.33}{23} \right) (11.67) = 171,700 \text{ lb-ft}$$

B5 CRACK 27.5

$$f_b = 35770 \text{ psi} - NG \gg 24000 \text{ psi}$$

REINFORCE B-6 x 23' LG

(Add WT9x17.5 WELDED TO BOTTOM FLANGE)

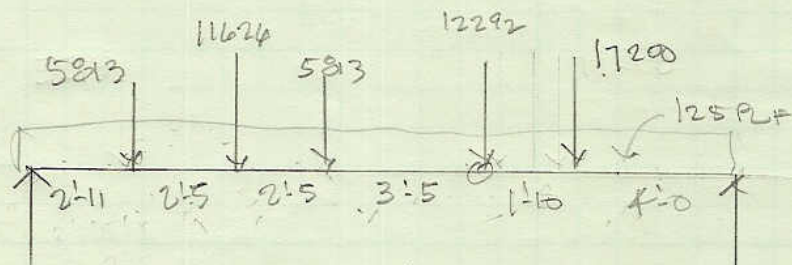


$$I = \frac{13.53}{18+9} I_{WT9} = 2.25 I_{WT9} = 1148$$

$$S = \frac{1148}{13.5} = 85$$

$$f_b = 24240 \text{ psi} \sim 24000 \text{ psi} \quad \text{OK}$$

BL
W18x35
L=17'
S=57.6



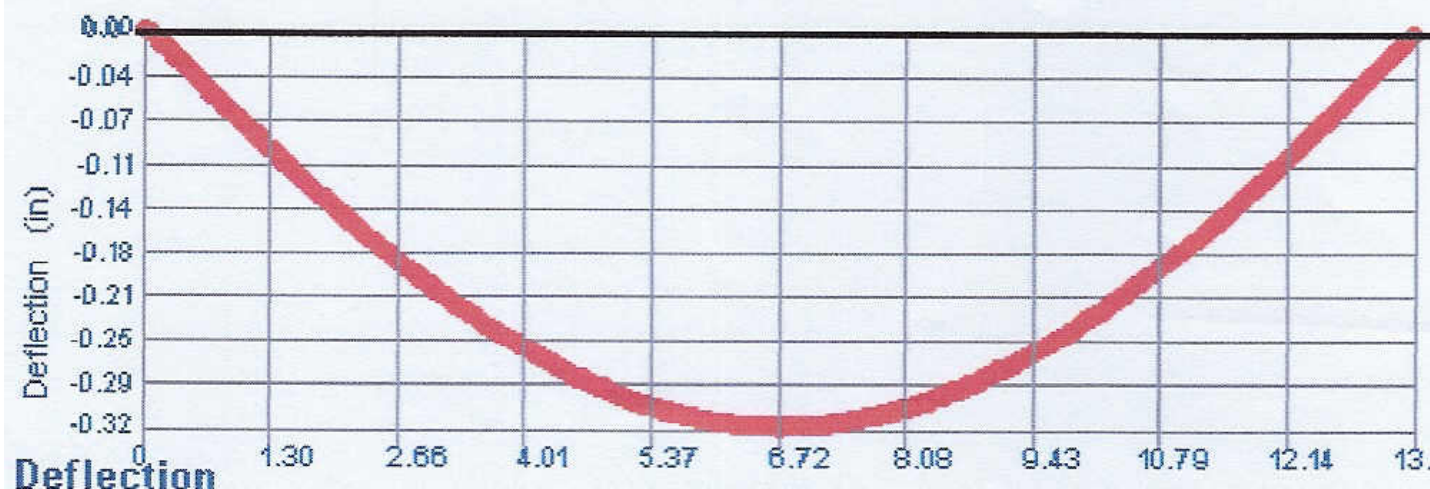
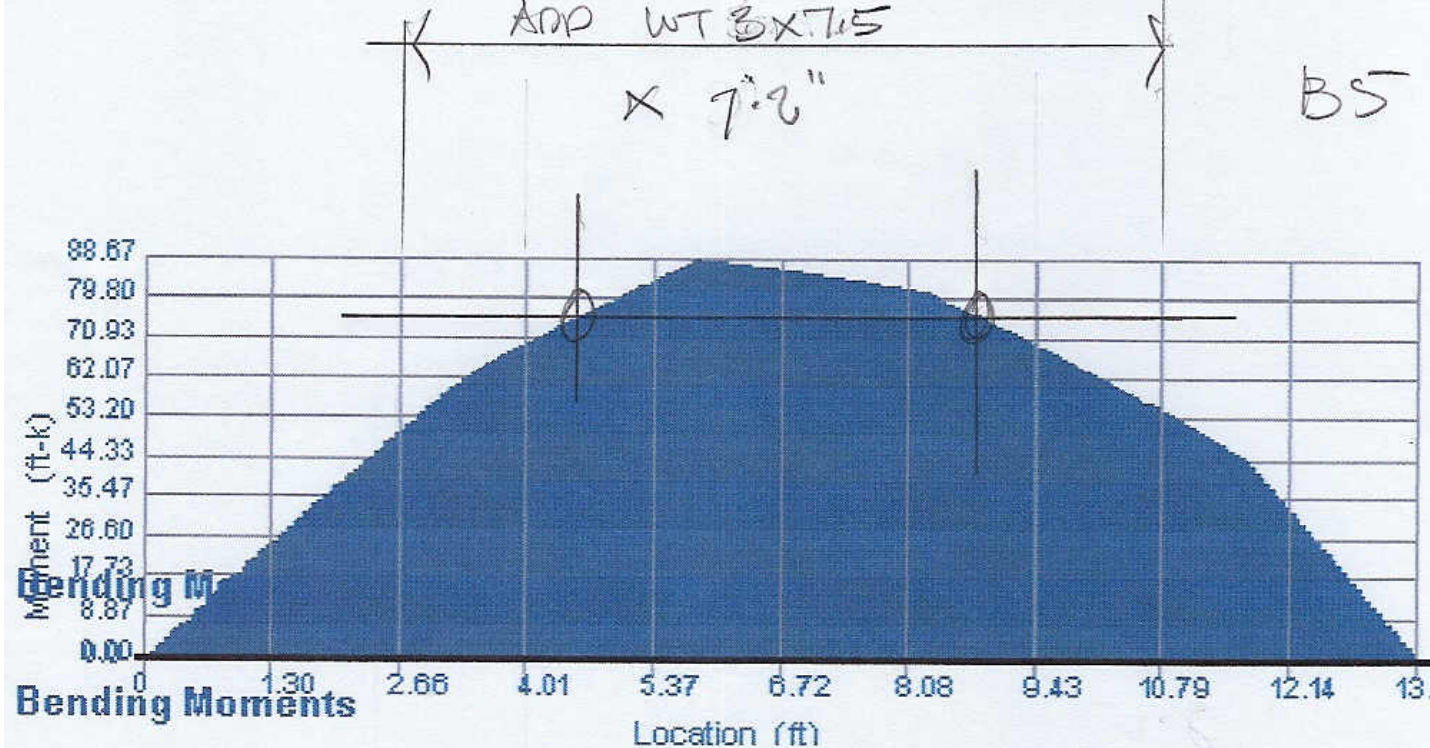
$$R_L = 17200(4) + 12292(5.83) + 5813(9.25) + 11624(11.67) + 5813(4.08)$$

$$+ 125(17) \frac{1}{2} = 25283 \frac{17}{2} \text{ lb}$$

$$R_R = 29586 \text{ lb}$$

$$M = 29586(5.83) - 17200(11.83) - 125(5.83)^2 \frac{1}{2}$$

$$= 138,886 \text{ lb-ft}$$



$$M = \frac{11625}{2250} (10395) + 125 \left(\frac{1.83}{2} \right) \frac{(11667)^2}{8} = 55655 \text{ ft-lb}$$

$$f_b = 23029 \text{ psi} < 24000 - \text{OK}$$

B5
W16x24
L=13.6
S=384

$$\Delta R_L = 2250(11.67) + 1125(5.08) + 2250(7.15) + 1125(9.92) = 2778 \text{ #}$$

$$\Delta M = 2778(5.83) - 1125(2.42) = 13475 \text{ ft-lb}$$

$$\Delta f_b = \frac{13475(12)}{384} = 4211 \text{ psi} (+17.6\%)$$

$$M = \frac{11625}{2250} (13475) + 125 \left(\frac{11.33}{2} \right) \frac{(135)^2}{8} = 85753 \text{ ft-lb}$$

$$f_b = 26793 \text{ psi} - + 11.7\% \div 1.60 f_y$$

$f_y = 40000$

$$\text{DL + LL allowed } M = 1.05(38.4) \left(\frac{24000}{12} \right) = 90640 \text{ ft-lb}$$

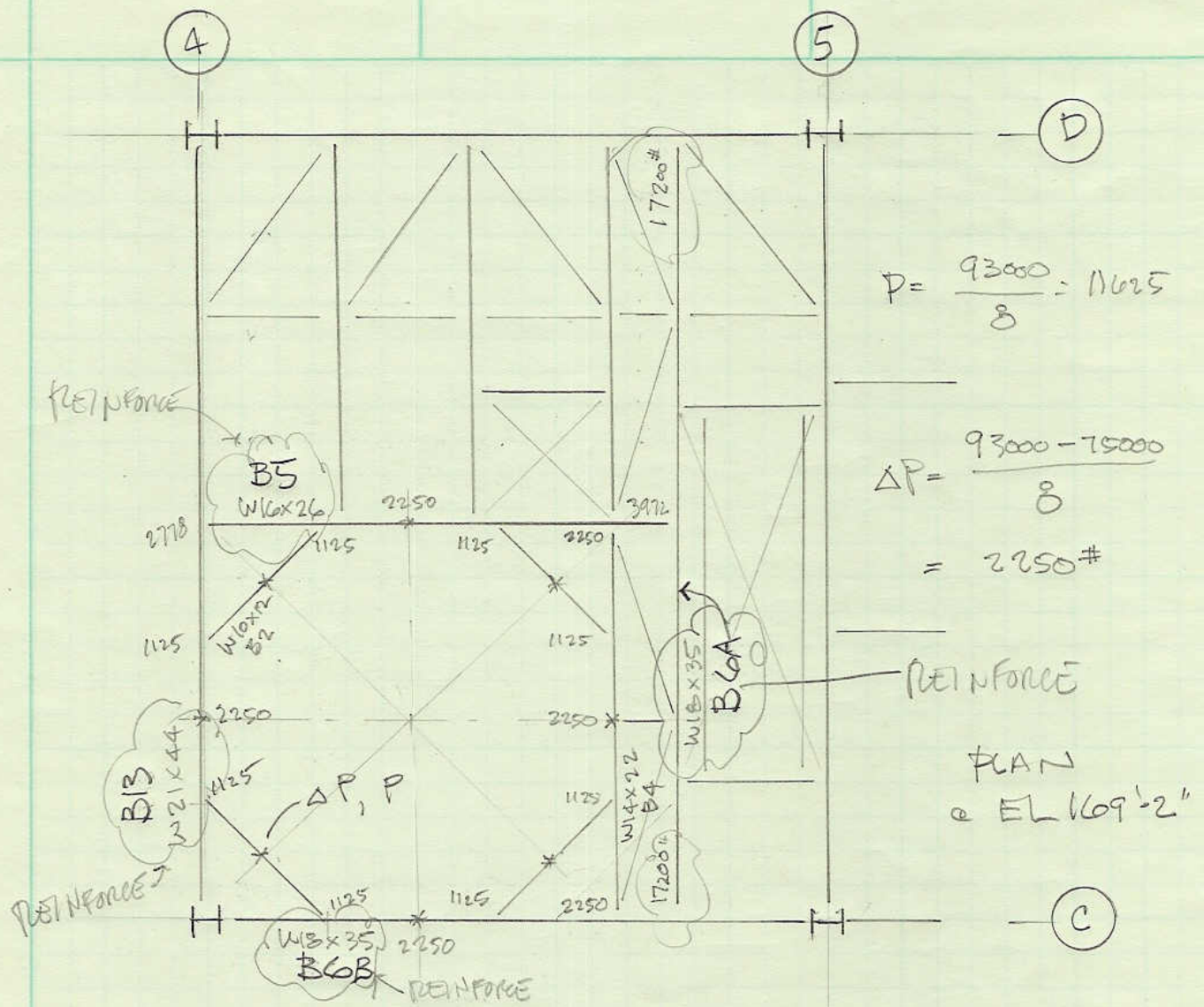
$$= \frac{69621}{11019 \text{ ft-lb}}$$

$$W = \frac{8(11019)}{13.5} = 483.7 \text{ PPF}$$

$$= \text{DL + LL} \left(\frac{11.33}{2} \right)$$

$$\text{DL + LL} = \frac{2(483.7)}{11.33} = 85.4 \text{ psf} - 25 = 60.4 \text{ psf}$$

NOTE: MIN CENTS FOR STEEL WILL SHOW $f_y > 36000$
USUALLY \therefore LL > 60.4 ALLOWED \rightarrow 100 PSF



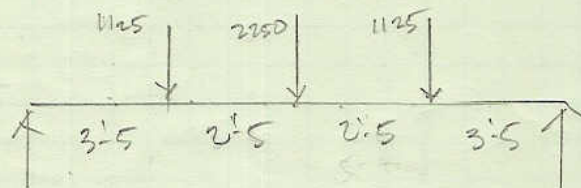
B2
W10x12
L = 4.83'
S = 10.9

$$\Delta M = \frac{2250(4.83)}{4} = 2715 \text{ l-#}$$

$$\Delta f_b = \frac{2715(12)}{10.9} = 2989 \text{ psi } (+12.5\%)$$

$$f_b = \frac{11625}{2250}(2989) = 15445 \text{ psi } \textcircled{OK}$$

B4
W14x22
L = 11'-8
S = 29.0



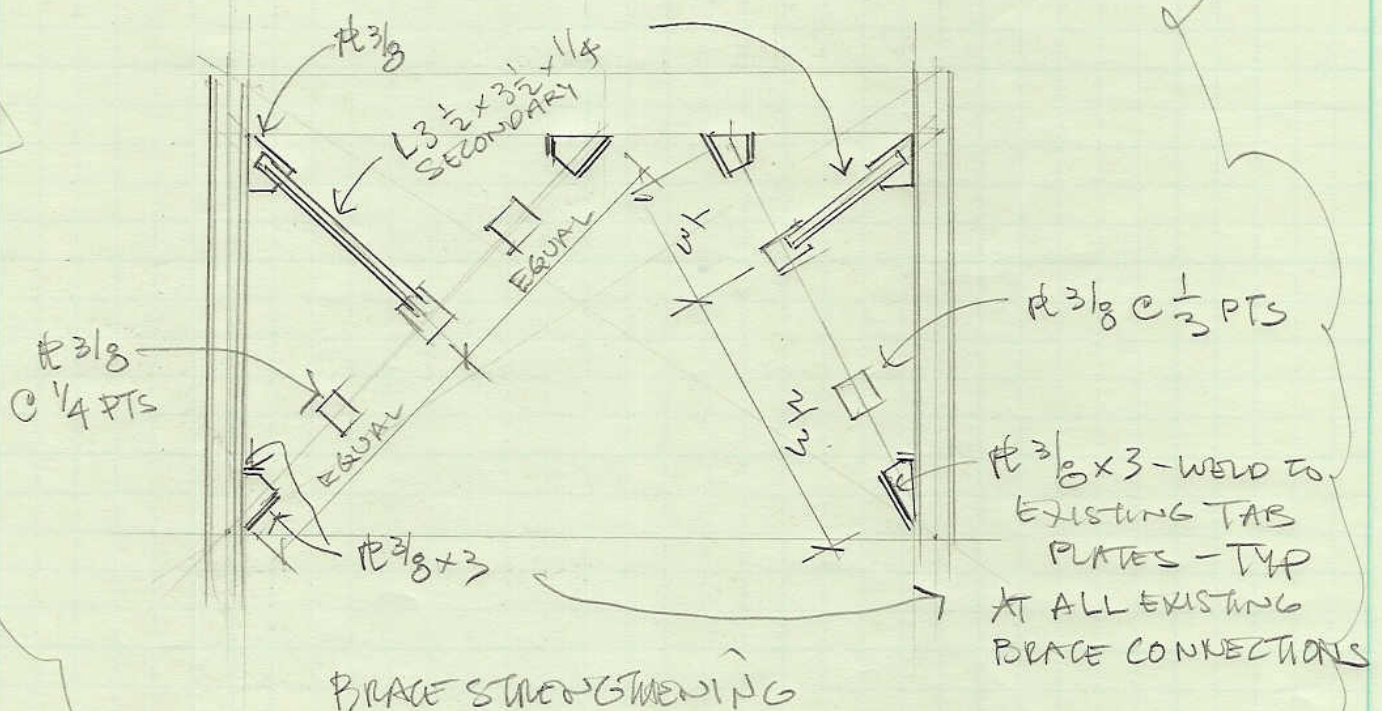
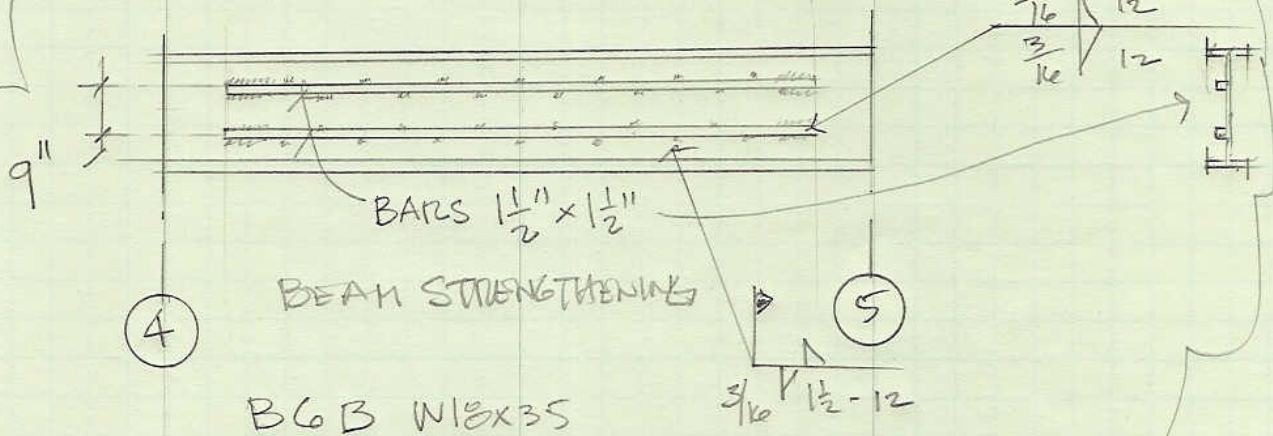
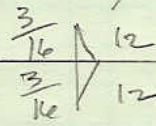
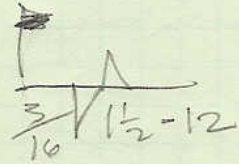
$$\Delta R = 1125 + \frac{2250}{2} = 2250$$

$$\Delta M = 2250(5.83) - 1125(2.42) = 10395 \text{ l-#}$$

$$\Delta f_b = \frac{10395(12)}{29.0} = 4301 \text{ psi } (+17.9\%)$$

$$Q = 2.25(4.5) = 10.1$$

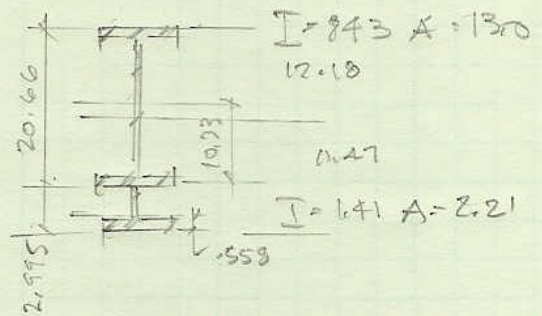
$$\frac{VQ}{I} = \frac{29(10.1)}{604} = 487 \text{ psi} \quad 3/16 \text{ @ } 12"$$



$$N.A.X \quad \frac{2.21(1.558)}{13(2.995+10.33)} = 1.233$$

$$15.21 \times \bar{y} = 174.458$$

$$\bar{y} = 11.47"$$



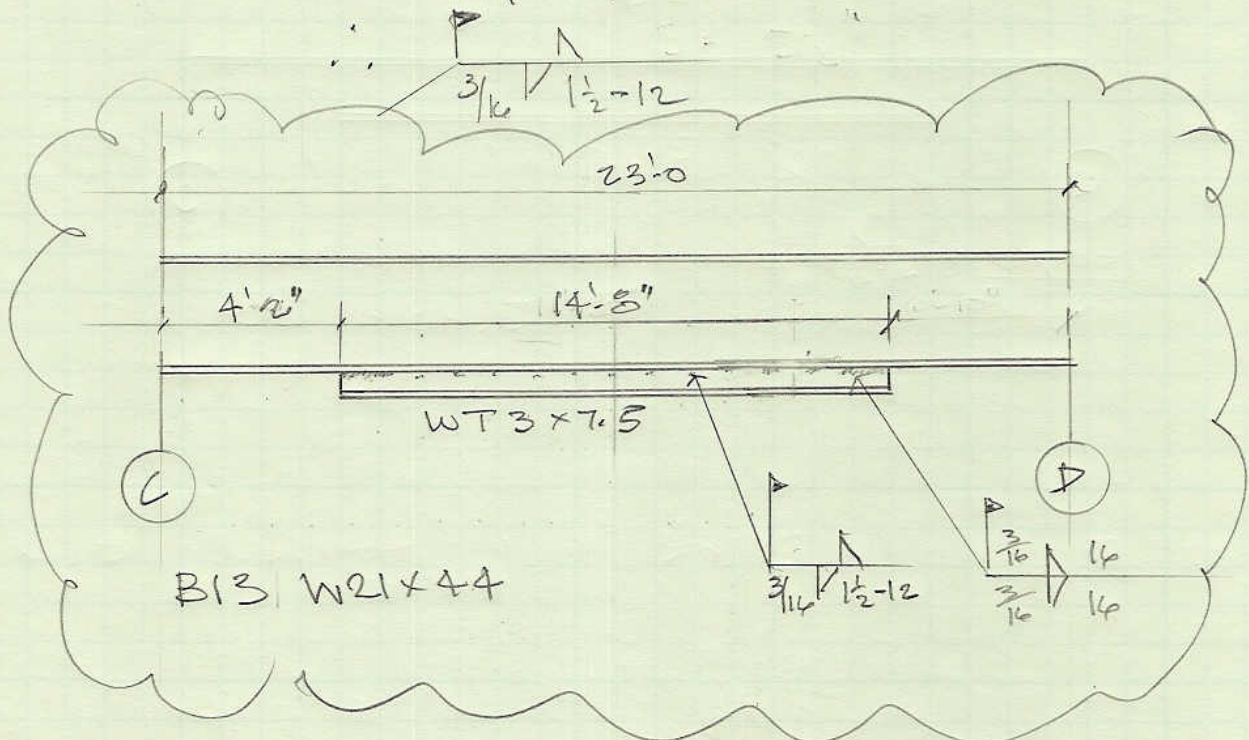
$$I = 843 + 1.41 + 13(11.47 - 2.995 - 10.33)^2 + 2.21(11.47 - 0.558)^2 = 1152 \text{ in}^4$$

$$S_T = 94.6 \quad S_B = 100.5$$

$$f_b = \frac{187.2(12)}{100.5} = 22.4 \text{ ksi} \quad f_{bT} = 23.8 \text{ ksi} \quad (OK)$$

$$f = \frac{VQ}{I} \quad Q = 2.21(11.47 - 0.558) = 24.1 \text{ in}^3$$

$$= \frac{28(24.1)}{1152(1.23)} = 2.55 \text{ ksi} (1.23) = 586 \text{ ppi}$$



$$S_T = 97.1 \quad S_D = 107.5$$

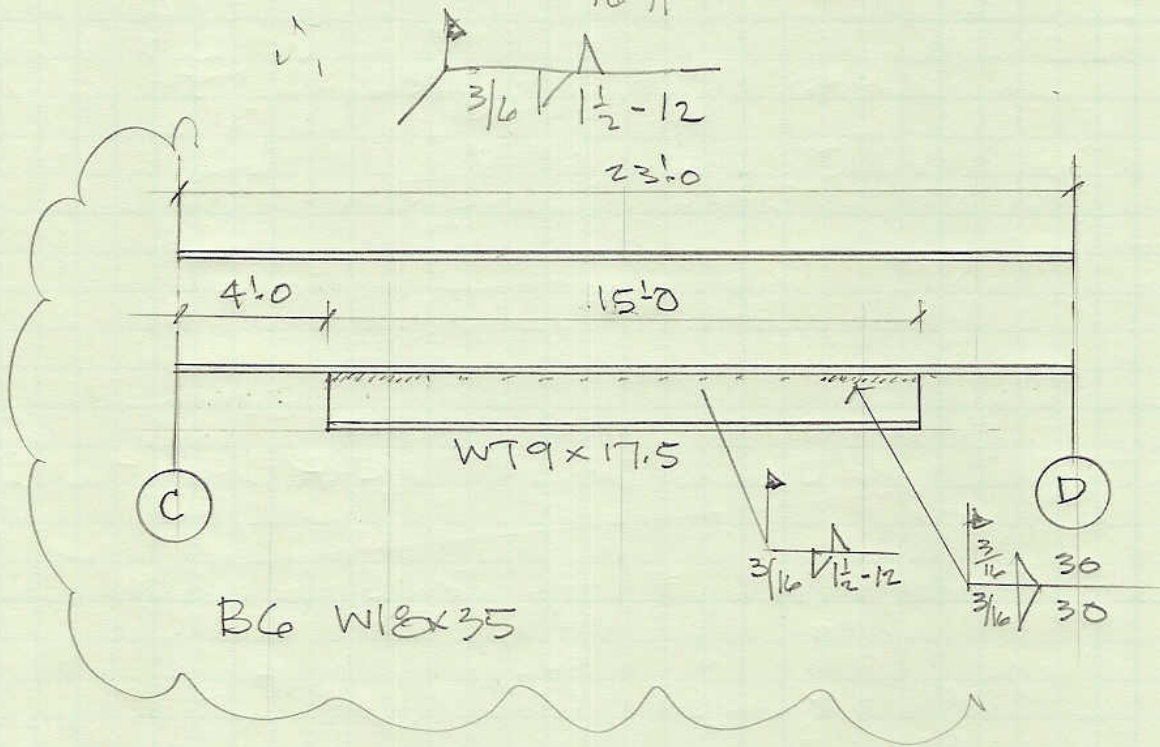
$$f_b = \frac{17374(12)}{97.1} = 21.5 \text{ ksi} \quad \text{OK}$$

$$Q = 5.15 (126 - 239) = 52.58$$

$$f = \frac{17,800 (52.58)}{1355} = 691 \text{ ppi}$$

$$\text{For } 3/16 \text{ weld } 928 (3) = 2784 \text{ ppi} \times 1.5 = 4176$$

$$S = 4176 / 691 = 6"$$



$$B13 \quad W21 \times 44 \quad W \mid WT 3 \times 7.5 \quad A_s = 2.21 \quad t_w = .23"$$

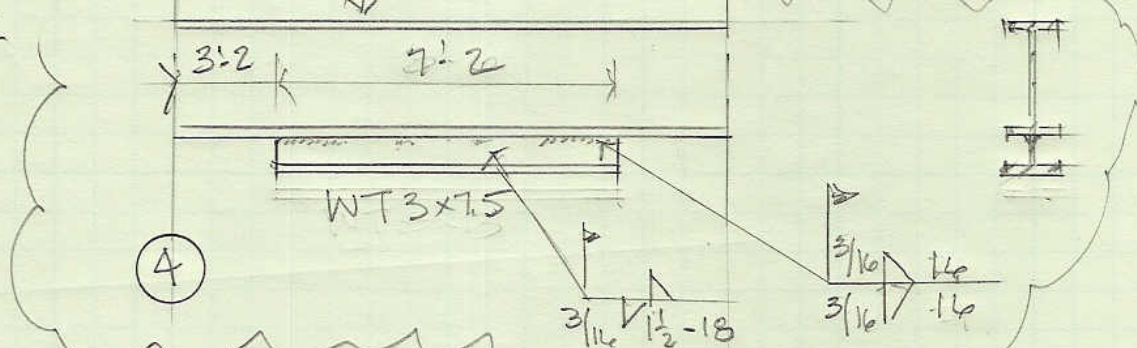
$$f_b \approx 27.5 \left(\frac{21}{21+3} \right) = 24.1 \text{ ksi}$$

$$F \approx 24.1 (2.21) = 53.2 \text{ k}$$

$$l_{\text{weld}} = \frac{53.2}{.3(14.4)} = 12.3" \rightarrow 16"$$

BEAM STRENGTHENING

B5 W16x24 - W WT3x7.5 $A_s = 2.21 \text{ in}^2$ $t_w = .23$
 $13'-6"$ 12.558



$$f_b \approx 27.71 \left(\frac{1/4}{1/4 + 3} \right) = 29.33 \text{ ksi}$$

$$F = 29.33 (2.21) = 51.6 \text{ k}$$

$$L_{weld} = \frac{51.6}{.23 (14.4)} = 15.6" \rightarrow 16"$$

B6A W18x35 - W WT9x17.5 $A_s = 5.15$ $t_w = .3$

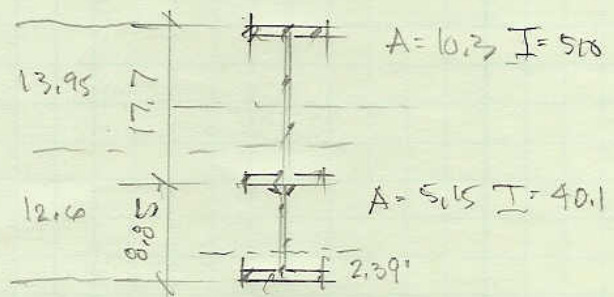
$$f_b \approx 36.5 \left(\frac{1/8}{1/8 + 9} \right) = 24.3 \text{ ksi}$$

$$F \approx 24.3 (5.15) = 125.3 \text{ k}$$

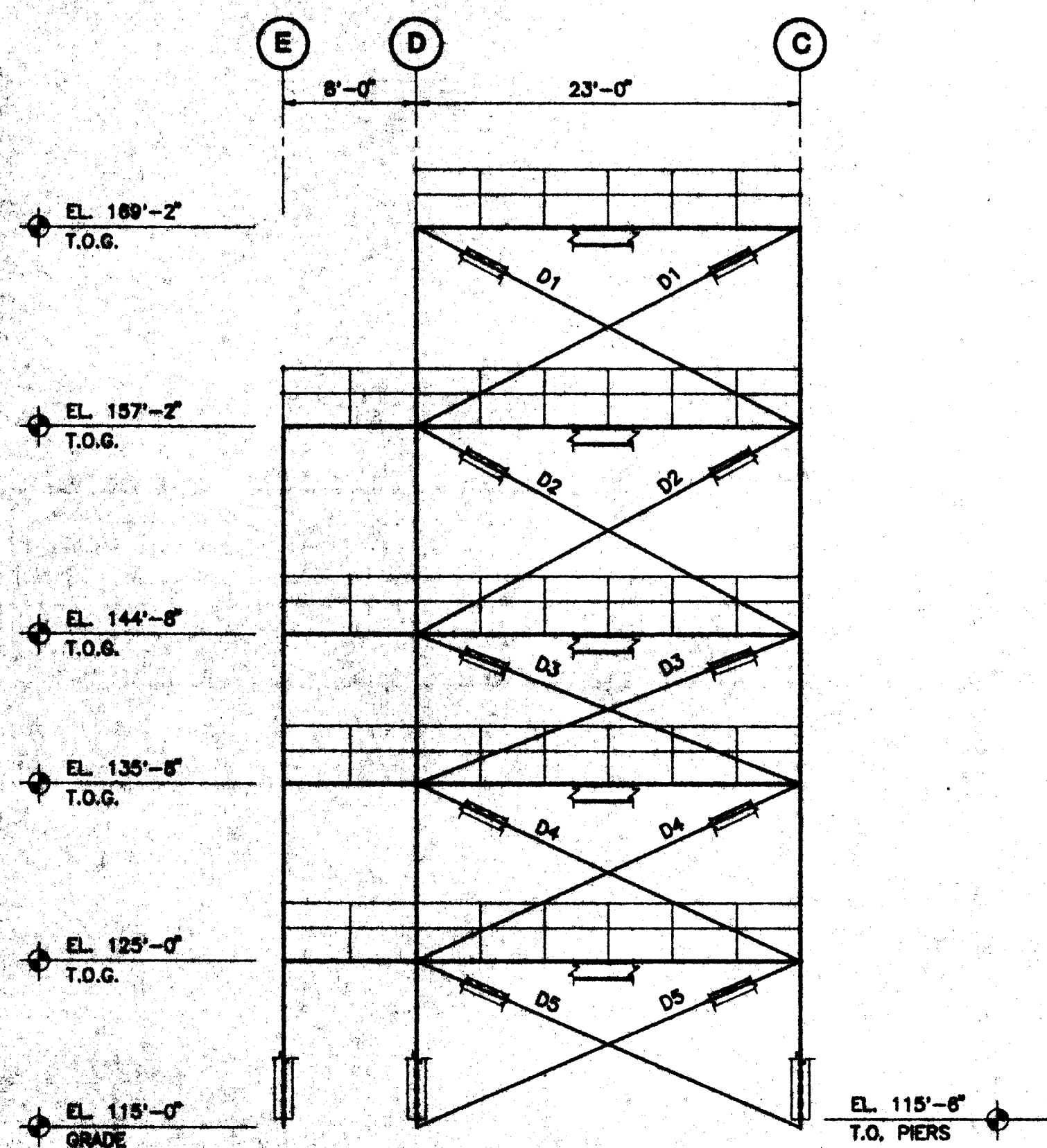
$$L_{weld} = \frac{125.3}{.3 (14.4)} = 29" \rightarrow 30"$$

$$f = \frac{VQ}{I}$$

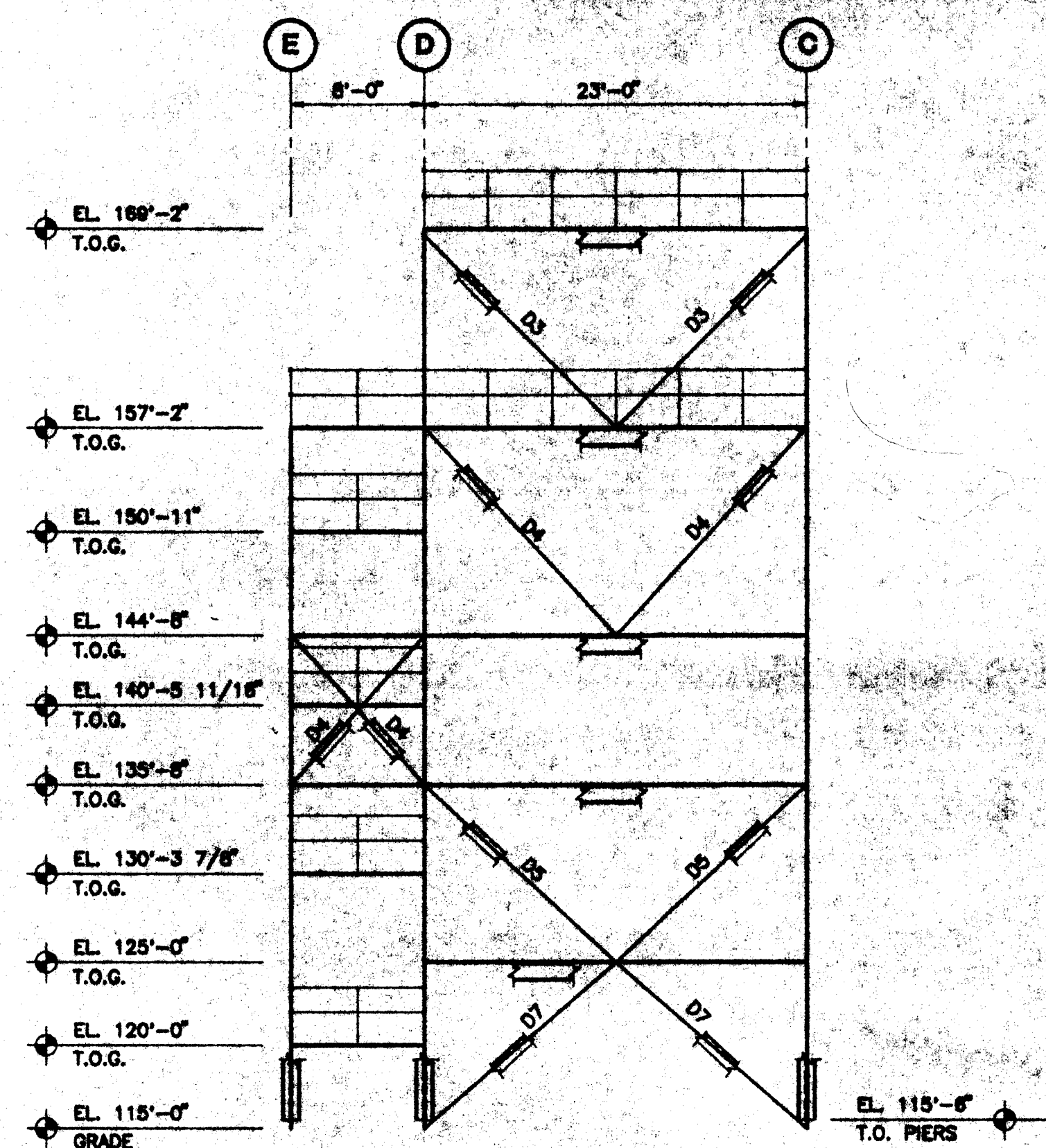
$$\begin{aligned} \text{N.A.} &= 5.15 (2.39) = 12.31 \\ &= 10.3 (8.85 + 8.85) = 182.31 \\ &= 15.45 \times \bar{y} = 194.62 \\ &\bar{y} = 12.6" \end{aligned}$$



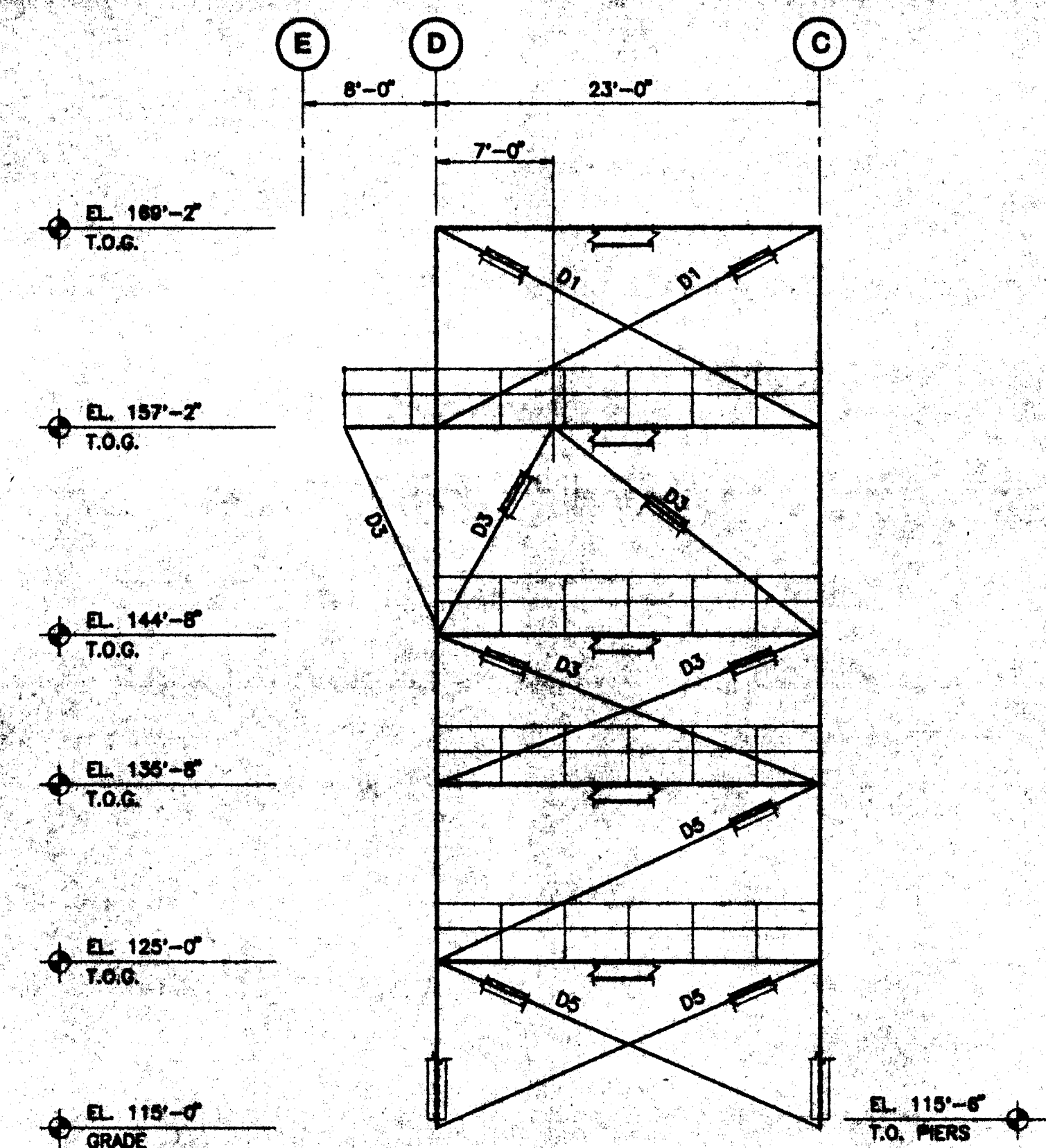
$$I = 510 + 40.1 + 5.15 (12.6 - 2.39)^2 + 10.3 (17.7 - 12.6)^2 = 1355 \text{ in}^4$$



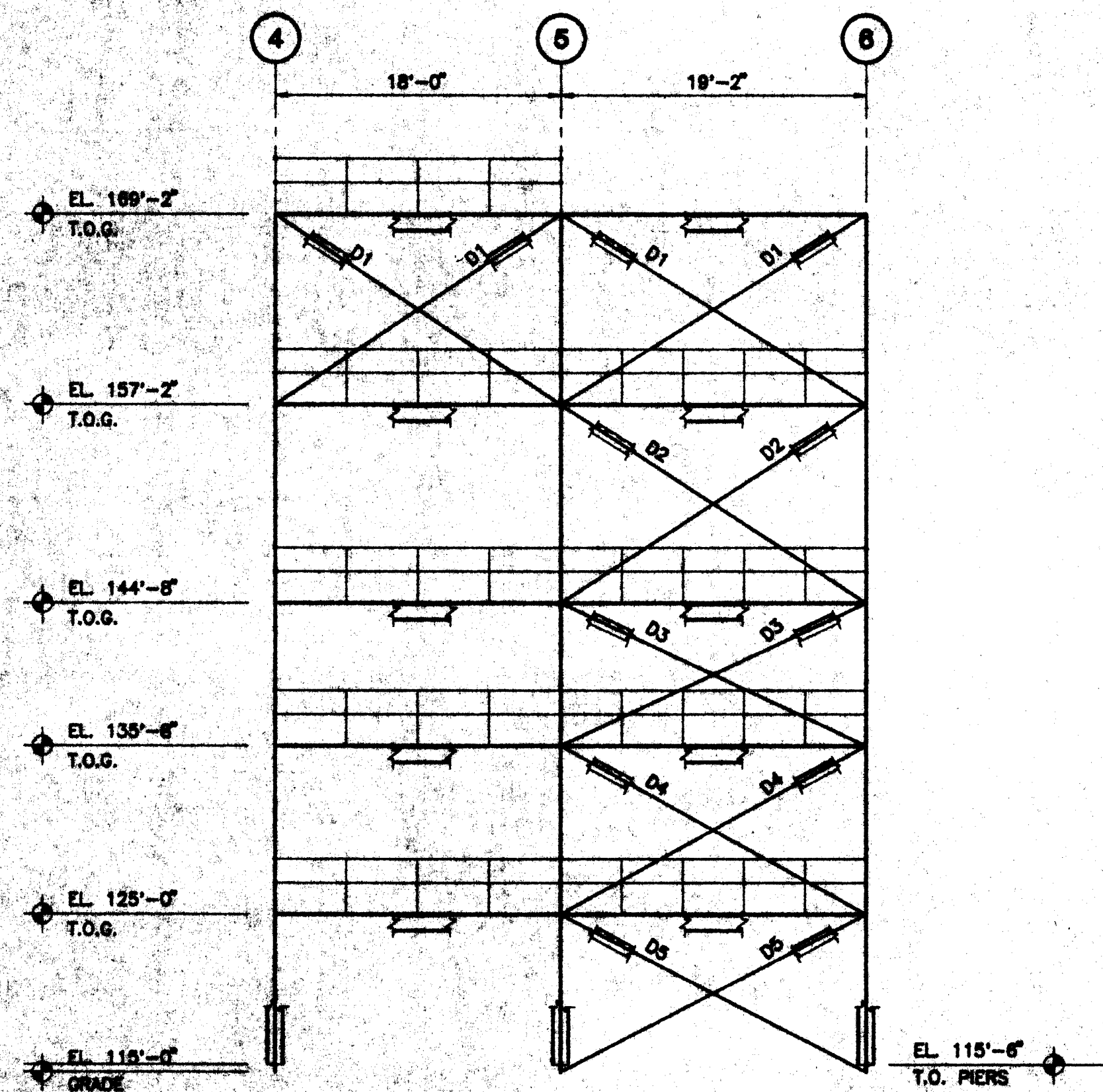
ELEV. ALONG GRID ④
(LOOKING EAST) 1/8"=1'-0"



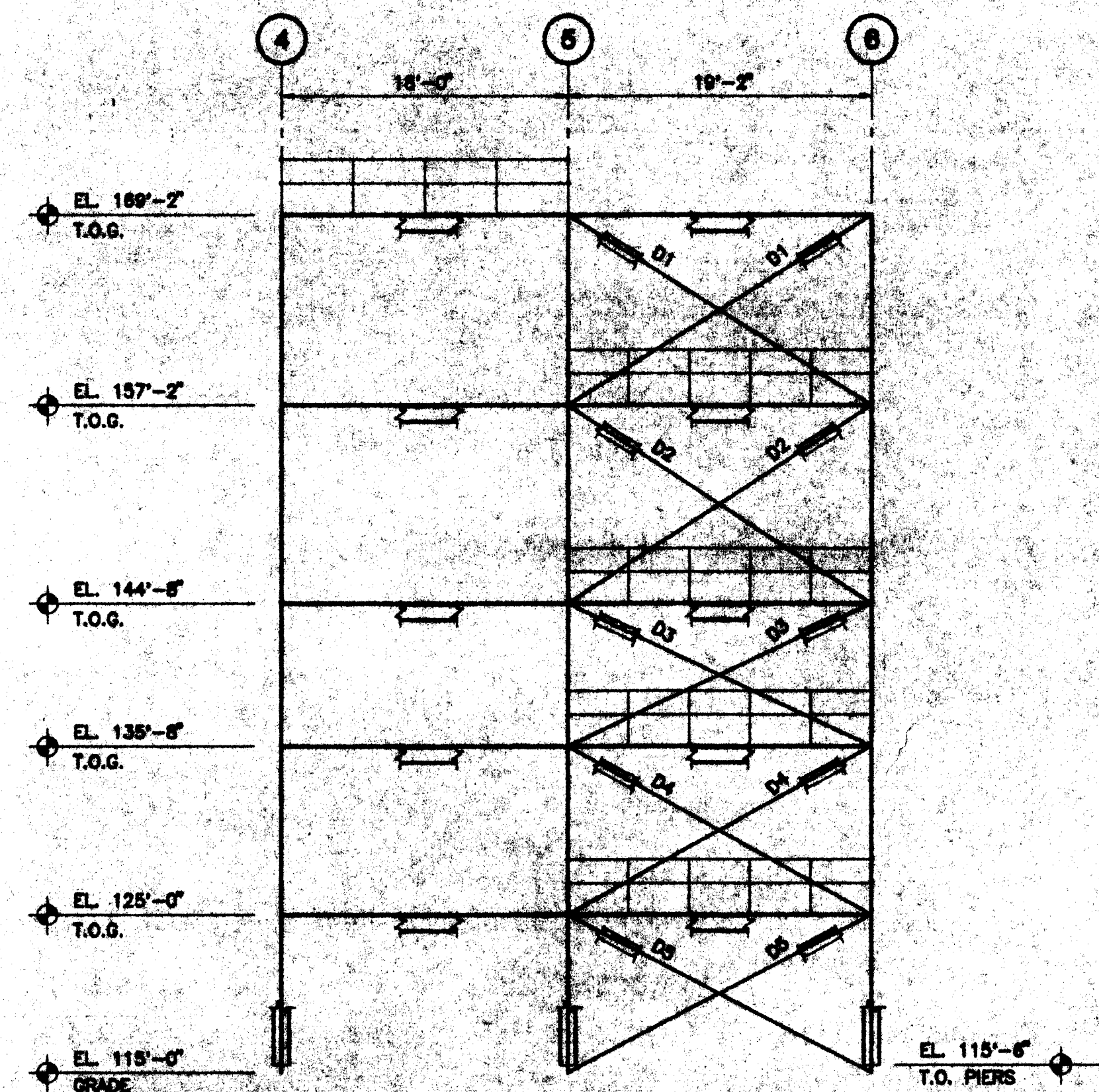
ELEV. ALONG GRID ⑤
(LOOKING EAST) 1/8"=1'-0"



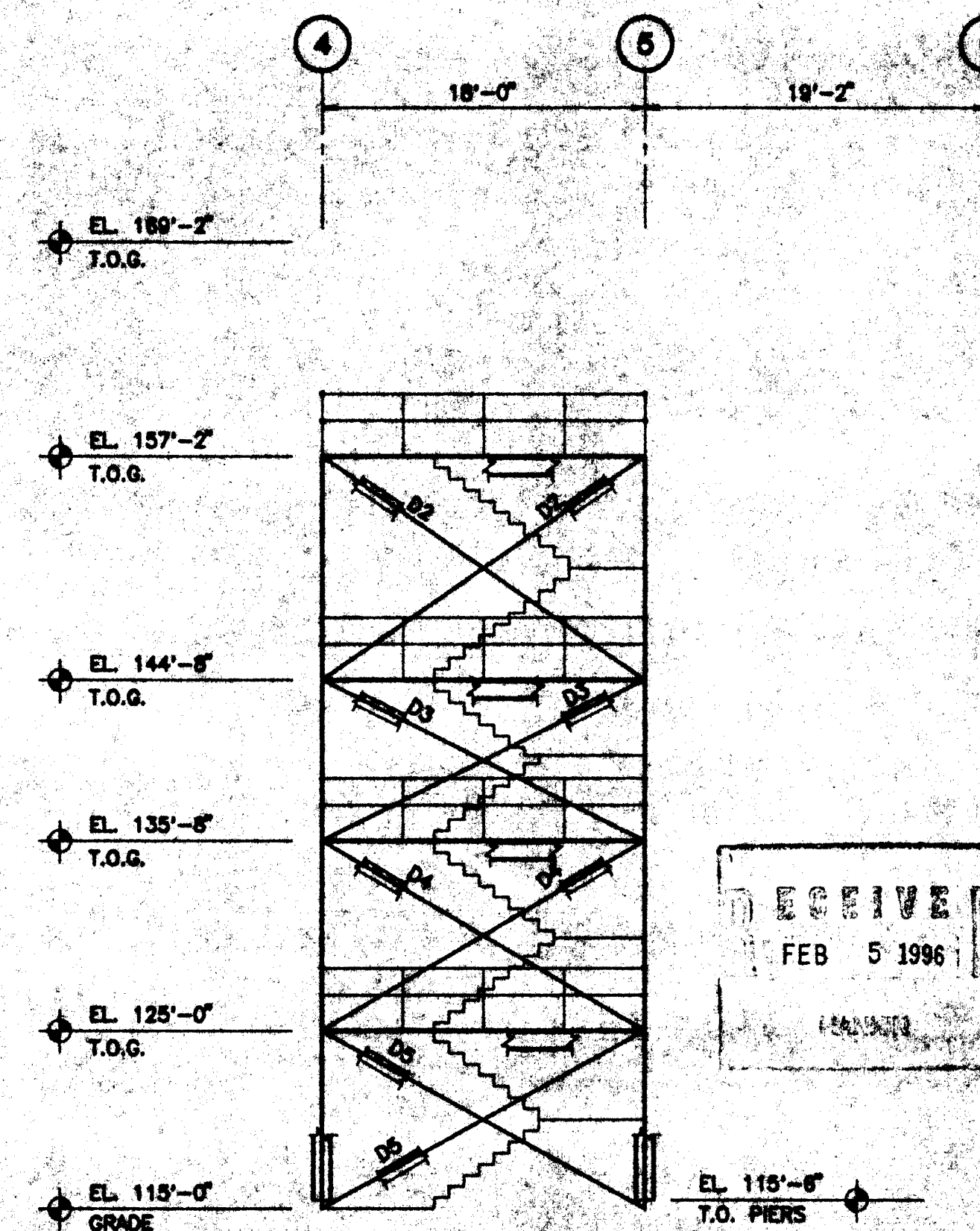
ELEV. ALONG GRID ⑥
(LOOKING EAST) 1/8"=1'-0"



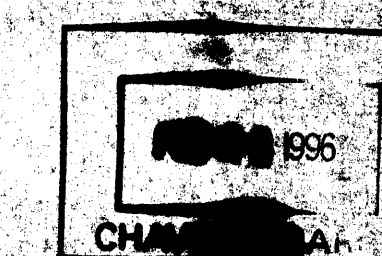
ELEV. ALONG GRID ③
(LOOKING NORTH) 1/8"=1'-0"



ELEV. ALONG GRID ④
(LOOKING NORTH) 1/8"=1'-0"



ELEV. ALONG GRID ⑤
(LOOKING NORTH) 1/8"=1'-0"



ISSUED
ENGINEERING DEPT.
FEB 5 1996
HANKIN ENVIRONMENTAL
SYSTEMS INC.

BRACE SCHEDULE	
MARK	SIZE
D1	(2) L3 3/2 X 2 3/2 X 1/4
D2	(2) L3 1/2 X 3 X 1/4
D3	(2) L4 X 3 X 1/4
D4	(2) L4 X 3 1/2 X 1/4
D5	(2) L5 X 3 1/2 X 5/16
D6	NOT USED
D7	(2) L4 X 3 1/2 X 5/8

SCHEMATIC
NOT FOR CONSTRUCTION USE

AVSCHWAN & ASSOC. Inc.
CONSULTING ENGINEERS
700 E. CAMDEN RD. STE. 128
SURREY, BRIT. COLUMBIA V3V 2S1
(604) 265-1331

AVSCHWAN & ASSOC. Inc.
CONSULTING ENGINEERS
700 E. CAMDEN RD. STE. 128
SURREY, BRIT. COLUMBIA V3V 2S1
(604) 265-1331

HANKIN ENVIRONMENTAL SYSTEMS INC.

S5

Exhibit C - Hazardous Waste Characteristics

Table 1 - EPA Listed Hazardous Wastes

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
D001	A SOLID WASTE THAT EXHIBITS THE CHARACTERISTIC OF IGNITABILITY
D004	ARSENIC
D005	BARIUM
D006	CADMIUM
D007	CHROMIUM
D008	LEAD
D009	MERCURY
D010	SELENIUM
D011	SILVER
D012	ENDRIN
D013	LINDANE
D014	METHOXYCHLOR
D015	TOXAPHENE
D016	2,4-D
D017	2,4,5-(SILVEX)
D018	BENZENE
D019	CARBON TETRACHLORIDE
D020	CHLORDANE
D021	CHLOROBENZENE
D022	CHLOROFORM
D023	O-CRESOL
D024	M-CRESOL
D025	P-CRESOL
D026	CRESOL
D027	1,4-DICHLOROBENZENE
D028	1,2-DICHLOROETHANE
D029	1,1-DICHLOROETHYLENE
D030	2,4-DITROTOLUENE
D031	HEPTACHLOR (AND ITS EPOXIDE)
D032	HEXACHLOROBENZENE
D033	HEXACHLOROBUTADIENE
D034	HEXACHLOROETHANE
D035	METHYL ETHYL KETONE
D036	NITROBENZENE
D037	PENTRACHLOROPHENOL

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
D038	PYRIDINE
D039	TETRACHLOROETHYLENE
D040	TRICHLOROETHYLENE
D041	2,4,5-TRICHLOROPHENOL
D042	2,4,6-TRICHLOROPHENOL
D043	VINYL CHLORIDE
F001	SPENT HALOGENATED SOLVENTS USED IN DEGREASING: TETRACHLOROETHYLENE, TRICHLOROETHYLENE, METHYLENE CHLORIDE, 1,1,1- TRICHLOROETHANE, CARBON TETRACHLORIDE, CHLORINATED FLUOROCARBONS; AND MIXTURES/BLENDS CONTAINING A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) BEFORE USE OF ONE OR MORE OF THE ABOVE SOLVENTS OR SOLVENTS LISTED IN F002, F004 AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF SPENT SOLVENTS AND MIXTURES
F002	TETRACHLOROETHYLENE, METHYLENE CHLORIDE, TRICHLOROETHYLENE, 1,1,1- TRICHLOROETHANE, CHLOROBENZENE, 1,1,2-TRICHLOROETHANE; AND MIXTURES/BLENDS CONTAINING A TOTAL OF 10% OR MORE (BY VOLUME) BEFORE USE OF ONE OR MORE OF THE ABOVE SOLVENTS OR SOLVENTS LISTED IN F002, F004 AND F005 AND STILL BOTTOMS FROM RECOVERY OF SPENT SOLVENTS AND MIXTURES
F003	XYLENE, ACETONE ETHYL ACETATE, ETHYL BENZENE, ETHYL ETHER, METHYL ISOBUTYL KETONE, N-BUTYL ALCOHOL, CYCLOHEXANANE, METHANOL; MIXTURES/BLENDS OF ABOVE; AND 10% OR MORE (BY VOLUME) OF F001, F002, F004, F005; AND STILL BOTTOMS FROM RECOVERY OF SPENT SOLVENTS
F004	CRESOLS AND CRESYLIC ACID, NOTROBENZENE; SOLVENT MIXTURES/BLENDS OF 10% OR MORE BEFORE USE OF ONE OR MORE OF ABOVE OR F001, F002, F005; STILL BOTTOMS FROM RECOVERY OF SPENT SOLVENTS
F005	TOLUENE, METHYL ETHYL KETONE, CARBON DISULFIDE, ISOBUTANOL, PYRIDINE, BENZENE, 2-ETHOXYETHANOL, 2-NITROPROPANE; MIXTURES/BLENDS OF 10% OR MORE (BY VOLUME) OF ABOVE OR SOLVENTS LISTED IN F001, F002, F004 AND STILL BOTTOMS FROM RECOVERY OF SOLVENTS
F006	WASTEWATER TREATMENT SLUDGES FROM ELECTROPLATING OPERATIONS EXCEPT FROM SULFURIC ACID ANODIZING OF ALUMINUM; TIN PLATING ON CARBON STEEL; ZINC PLATING ON CARBON STEEL; ALUMINUM, ZINC ALUMINUM PLATING ON CARBON STEEL; CLEANING/STRIPPING ASSOCIATED WITH TIN, ZINC AND ALUMINUM PLATING ON CARBON STEEL; AND CHEMICAL ETCHING AND MILLING OF ALUMINUM
F012	QUENCHING WASTEWATER TREATMENT SLUDGES FROM METAL HEAT TREATING OPERATIONS WHERE CYANIDES ARE USED
F019	WASTEWATER TREATMENT SLUDGES FROM CHEMICAL CONVERSION COATING OF ALUMINUM EXCEPT ZIRCONIUM PHOSPHATING IN ALUMINUM CAN WASHING
F025	CONDENSED LIGHT ENDS, SPENT FILTERS AND AIDS, SPENT DESICCANT WASTES FROM PRODUCTION OF CERTAIN CHLORINATED ALIPHATIC HYDROCARBONS (HAVING CARBON CHAIN LENGTHS RANGING FROM 1-5 WITH VARYING AMOUNTS

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
	AND POSITIONS OF CHLORINE SUBSTITUTION) BY FREE RADICAL CATALYZED PROCESSES.
F035	WASTEWATERS, PROCESS RESIDUALS, PRESERVATIVE DRIPPAGE, AND SPENT FORMULATIONS FORM WOOD PRESERVING PROCESS GENERATED AT PLANTS THAT USE INORGANIC PRESERVATIVES CONTAINING ARSENIC OR CHROMIUM. DOES NOT INCLUDE K001 BOTTOM SEDIMENT SLUDGE FROM TREATMENT OF WASTEWATER FROM WOOD PRESERVING PROCESSES USING CREOSOTE AND/OR PENTACHLOROPHENOL
F037	PETROLEUM REFINERY PRIMARY OIL/WATER/SOLIDS SEPARATION SLUDGE. SLUDGE FROM GRAVITATIONAL SEPARATION OF OIL/WATER/SOLIDS DURING STORAGE OR TREATMENT OF PROCESS WASTEWATERS AND OILY COOLING WASTEWATERS FROM PETROLEUM REFINERIES. (OIL/WATER/SOLIDS SEPARATORS; TANKS AND IMPOUNDMENTS; DITCHES/CONVEYANCES; SUMPS; STORMWATER UNITS. SLUDGES FROM NON-CONTACT ONCE-THROUGH COOLING WATERS, SLUDGES FROM AGGRESSIVE BIOLOGICAL TREATMENT UNITS, K051 WASTES
F038	PETROLEUM REFINERY SECONDARY (EMULSIFIED) OIL/WATER/SOLIDS SEPARATION SLUDGE-ANY SLUDGE AND/OR FLOAT GENERATED FROM THE PHYSICAL AND/OR CHEMICAL SEPARATION OF OIL/WATER/SOLIDS IN PROCESS WASTEWATERS AND OILY COOLING WASTEWATERS FROM PETROLEUM REFINERIES. SUCH WASTES INCLUDE, BUT ARE NOT LIMITED TO, ALL SLUDGES AND FLOATS GENERATED IN: INDUCED AIR FLOTATION (IAF) UNITS, TANKS AND IMPOUNDMENTS, AND ALL SLUDGES GENERATED IN DAF UNITS. SLUDGES GENERATED IN STORMWATER UNITS THAT DO NOT RECEIVE DRY WEATHER FLOW, SLUDGES GENERATED FROM NON-CONTACT ONCE-THROUGH COOLING WATERS SEGREGATED FOR TREATMENT FROM OTHER PROCESS OR OILY COOLING WATERS, SLUDGES AND FLOATS GENERATED IN AGGRESSIVE BIOLOGICAL TREATMENT UNITS (INCLUDING SLUDGES AND FLOATS GENERATED IN ONE OR MORE ADDITIONAL UNITS AFTER WASTEWATERS HAVE BEEN TREATED IN AGGRESSIVE BIOLOGICAL TREATMENT UNITS) AND F037, K048, AND K051 WASTES ARE NOT INCLUDED IN THIS LISTING.
F039	LEACHATE FROM DISPOSAL OF MORE THAN ONE RESTRICTED WASTE (HAZARDOUS UNDER SUBPART D; RESULTING FROM THE DISPOSAL OF ONE OR MORE OF EPA HAZARDOUS WASTES: F020, F021, F022, F026, F027, AND/OR F028)
K001	WASTEWATER TREATMENT SLUDGE BOTTOM SEDIMENT THAT USE CREOSOTE AND/OR PENTACHLOROPHENOL
K002	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF CHROME YELLOW AND ORANGE PIGMENTS
K003	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF MOLYBDATE ORANGE PIGMENTS
K004	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF ZINC YELLOW PIGMENTS
K005	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF CHROME GREEN PIGMENTS
K006	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF CHROME OXIDE GREEN PIGMENTS (ANHYDROUS AND HYDRATED)

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
K007	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF IRON BLUE PIGMENTS
K008	OVEN RESIDUE FROM PRODUCTION OF CHROME OXIDE GREEN PIGMENTS
K009	DISTILLATION BOTTOMS FROM THE PRODUCTION OF ACETALDEHYDE FROM ETHYLENE
K010	DISTILLATION SIDE CUTS FROM PRODUCTION OF ACETALDEHYDE FROM ETHYLENE
K014	VICINALS FROM THE PURIFICATION OF TOLUENEDIAMINE IN THE PRODUCTION OF TOLUENEDIAMINE VIA THE HYDROGENATION OF DINITROTOLUENE
K015	STILL BOTTOMS FROM DISTILLATION OF BENZYL CHLORIDE
K016	HEAVY ENDS OR DISTILLATION RESIDUES FROM PRODUCTION OF CARBON TETRACHLORIDE
K017	HEAVY ENDS (STILL BOTTOMS) FROM PURIFICATION COLUMN IN PRODUCTION OF EPICHLOROHYDRIN
K018	HEAVY ENDS FROM FRACTIONATION COLUMN IN ETHYL CHLORIDE PRODUCTION
K019	HEAVY ENDS FORM THE DISTILLATION OF ETHYLENE DICHLORIDE IN ETHYLENE DICHLORIDE PRODUCTION
K020	HEAVY ENDS FROM DISTILLATION OF VINYL CHLORIDE IN VINYL CHLORIDE MONOMER PRODUCTION
K022	DISTILLATION BOTTOM TARS FROM PRODUCTION OF PHENOL/ACETONE FROM CUMENE
K023	DISTILLATION LIGHT ENDS FROM PRODUCTION OF PHTHALIC ANHYDRIDE FROM NAPHTHALENE
K024	DISTILLATION BOTTOMS FROM PRODUCTION OF PHTHALIC ANHYDRIDE FROM NAPHTHALENE
K025	DISTILLATION BOTTOMS FROM THE PRODUCTION OF NITROBENZENE BY THE NITRATION OF BENZENE
K026	STRIPPING STILL TAILS FROM PRODUCTION OF METHY ETHYL PYRIDINES
K029	WASTE FROM PRODUCT STEAM STRIPPER IN PRODUCTION OF 1,1,1-TRICHLOROETHANE
K030	COLUMN BOTTOMS OR HEAVY ENDS FROM COMBINED PRODUCTION OF TRICHLOROETHYLENE AND PERCHLOROETHYLENE
K031	BY-PRODUCT SALTS GENERATED IN PRODUCTION OF MSMA AND CACODYLIC ACID
K032	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF CHLORDANE
K033	WASTEWATER TREATMENT AND SCRUB WATER FROM CHLORINATION OF CYCLOPENTADIENE IN PRODUCTION OF CHLORDANE
K034	FILTER SOLIDS FROM FILTRATION OF HEXACHLOROCYCLOPENTADIENE IN PRODUCTION OF CHLORDANE
K035	WASTEWATER TREATMENT SLUDGES GENERATED IN PRODUCTION OF CREOSOTE
K036	STILL BOTTOMS FROM TOLUENE RECLAMATION DISTILLATION IN PRODUCTION OF DISULFOTON

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
K037	WASTEWATER TREATMENT SLUDGES FROM PRODUCTION DISULFOTON
K038	WASTEWATER FROM WASHING AND STRIPPING OF PHORATE PRODUCTION
K039	FILTER CAKE FROM FILTRATIN OF DIETHYLPHOSPHORODITHIOIC ACID IN PRODUCTION OF PHORATE
K040	WASTEWATER TREATMENT SLUDGE FROM PRODUCTION OF PHORATE
K041	WASTEWATER TREATMENT SLUDGE FORM PRODUCTION OF TOXAPHENE
K042	HEAVY ENDS OR DISTILLATION RESIDUES FROM DISTILLATION OF TETRACHLOROBENZENE IN PRODUCTION OF 2,4,5-T
K046	WASTEWATER TREATMENT SLUDGES FROM THE MANUFACTURING, FORMULATION AND LOADING OF LEAD-BASED INITIATING COMPOUNDS.
K048	DISSOLVED AIR FLOTATION FLOAT FROM PETROLEUM REFINING INDUSTRY
K049	SLOP OIL EMULSION SOLIDS FROM PETROLEUM REFINING INDUSTRY
K050	HEAT EXCHANGER BUNDLE CLEANING SLUDGE FROM PETROLEUM REFINING INDUSTRY
K051	API SEPARATOR SLUDGE FROM PETROLEUM REFINING INDUSTRY
K052	TANK BOTTOMS (LEADED) FROM PETROLEUM REFINING INDUSTRY
K061	EMISSION CONTROL DUST/SLUDGE FROM PRIMARY PRODUCTION OF STEEL IN ELECTRIC FURNACES
K064	ACID PLANT BLOWDOWN SLURRY/SLUDGE RESULTING FROM THE THICKENING OF BLOWDOWN SLURRY FROM PRIMARY COPPER PRODUCTION
K065	SURFACE IMPOUNDMENT SOLIDS CONTAINED IN AND DREDGED FROM SURFACE IMPOUNDMENTS AT PRIMARY LEAD SMELTING FACILITIES.
K066	SLUDGE FROM TREATMENT OF PROCESS WASTEWATER AND/OR ACID PLANT BLOWDOWN FROM PRIMARY ZINC PRODUCTION
K071	BRINE PURIFICATION MUDS FROM MERCURY CELL PROCESS IN CHLORINE PRODUCTION WHERE SEPARATELY PREPURIFIED BRINE IS NOT USED
K073	CHLORINATED HYDROCARBON WASTE FROM PURIFICAITON STEP OF THE DIAPHRAGM CELL PROCESS USING GRAPHITE ANODES IN CHLORINE PRODUCTION
K083	DISTILLATION BOTTOMS FROM ANILINE PRODUCTION
K084	WASTEWATER TREATMENT SLUDGES GENERATED DURING PRODUCTION OF VETERINARY PHARMACEUTICALS FROM ARSENIC OR ORGANO-ARSENIC COMPOUNDS
K085	DISTILLATION OR FRACTIONATION COLUMN BOTTOMS FROM PRODUCTION OF CHLOROBENZENES
K086	SOLVENT WASHES AND SLUDGES, CAUSTIC WASHES AND SLUDGES, OR WATER WASHES AND SLUDGES FROM CLEANING TUBS AND EQUIPMENT USED IN FORMULATION OF INK FROM PIGMENTS, DRIERS, SOAPS, STABILIZERS CONTAINING CHROMIUM AND LEAD
K087	DECANTER TANK TAR SLUGE FROM COKING
K088	SPENT POTLINERS FROM PRIMARY ALUMINUM REDUCTION

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
K090	EMISSION CONTROL DUST OR SLUDGE FROM FERROCHROMIUMSILICON PRODUCTION
K091	EMISSION CONTROL DUST OR SLUDGE FROM FERROCHROMIUM PRODUCTION
K093	DISTILLAION LIGHT ENDS FROM PRODUCTION OF PHTHALIC ANHYDRIDE FROM ORTHO-XYLENE
K094	DISTILLATION BOTTOMS FROM PRODUCTION OF PHTHALIC ANHYDRIDE FROM ORTHO-XYLENE
K095	DISTILLAION BOTTOMS FROM PRODUCTION OF 1,1,1-TRICHLOROETHANE
K096	HEAVY ENDS FROM HEAVY ENDS COLUMN FROM PRODUCTION OF 1,1,1-TRICHLOROETHANE
K097	VACUUM STRIPPER DISCHARGE FROM CHLORDANE CHLORINATOR IN PRODUCTION OF CHLORDANE
K098	UNTREATED PROCESS WASTEWATER FROM PRODUCTION OF TOXAPHENE
K100	WASTE LEACHING SOLUTION FROM ACID LEACHING OF EMISSION CONTROL DUST/SLUDGE FROM SECONDARY LEAD SMELTING
K101	DISTILLATION TAR RESIDUES FROM DISTILLATIONOF ANILINE-BASED COMPOUNDS IN PRODUCTION OF VETERINARY PHARMACEUTICALS FROM ARSENIC OR ORGANO-ARSENIC COMPOUNDS
K102	RESIDUE FROM USE OF ACTIVATED CARBON FOR DECOLORIZATION IN PRODUCTION OF VETERINARY PHARMACEUTICALS FRO ARSENIC OR ORGANO-ARSENIC COMPOUNDS
K103	PROCESS RESIDUES FROM ANILINE EXTRACTION FROM PRODUCTIONOF ANILINE
K104	COMBINED WASTEWATER STREAMS GENERATED FROM NITROBENZENE/ANILINE PRODUCTION
K105	SEPARATED AQUEOUS STREAM FROM THE REACTOR PRODUCT WASHING STEP IN PRODUCTION OF CHLOROBENZENES
K106	WASTEWATER TREATMENT SLUDGE FROM MERCURY CELL PROCESS IN CHLORINE PRODUCTION
K112	REACTION BY-PRODUCT WATER FROM THE DRYING COLUMN IN PRODUCTION OF TOLUENEDIAMINE VIA HYDROGENATION OF DINITROTOLUENE
K113	CONDENSED LIQUID LIGHT ENDS FROM THE PURIFICATIONOF TOLUENEDIAMINE IN PRODUCTION OF TOLUENEDIAMINE VIA HYDROGENATION OF DINITROTOLUENE
K114	VICINALS FROM PURIFICAITON OF TOLUENEDIAMINE IN PRODUCTION OF TOLUENEDIAMINE VIA HYDROGENATION OF DINITROTOLUENE
K115	HEAVY ENDS FROM THE PURIFICATION OF TOLUENEDIAMINE IN PRODUCTION OF TOLUENEDIAMINE VIA HYDROGENATION OF DINITROTOLUENE
K116	ORGANIC CONDENSATE FROM SOLVENT RECOVERY COLUMN IN PRODUCTION OF TOLUENE DIISOCYANATE VIA PHOSGENATION OF TOLUENEDIAMINE
K117	WASTEWATER FROM THE REACTOR VENT GAS SCRUBBER IN PRODUCTION OF ETHYLENE DIBROMIDE VIA BROMINATION OF ETHENE
K118	SPENT ADSORBENT SOLIDS FROM PURIFICATION OF ETHYLENE DIBROMIDE IN PRODUCTION OF ETHYLENE DIBROMIDE VIA BROMINATION OF ETHENE

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
K125	FILTRATION, EVAPORATION, AND CENTRIFUGATION SOLIDS FROM THE PRODUCTION OF ETHYLENEBISDITHIOCARBAMIC ACID AND ITS SALTS.
K126	BAGHOUSE DUST AND FLOOR SWEEPINGS IN MILLING AND PACKAGING OPERATIONS FROM PRODUCTION OR FORMULATION OF ETHYLENE BIS DITHIOCARBAMIC ACID AND ITS SALTS
P001	2H-1-BENZOPYRAN-2-ONE, 4-HYDROXY-3-(3-OXO-1-PHENYLBUTYL)-, & SALTS, WHEN PRESENT AT CONCENTRATIONS GREATER THAN 0.3% WARFARIN, & SALTS, WHEN PRESENT AT CONCENTRAIONS GREATER THAN 0.3%
P002	ACETAMINE, N-(AMINOTHIOXOMETHYL); Also known as 1-ACETYL-2-THIOUREA
P003	ACROLEIN; Also known as 2-PROPENAL
P004	ALDRIN; Also known as 1,4,5,8-DIMETHANONAPHTHALENE, 1,2,3,4,10,10-HEXA-CHLORO-1,4,4A,5,8,8A,-HEXAHYDRO, (ALPHA, 4ALPHA, 4 ABETA, 5 ALPHA, 8ALPHA, 8ABETA)-
P005	ALLYL ALCOHOL; Also known as 2-PROPEN-1-OL
P007	5-(AMINOMETHYL)-3-ISOXAZOLOL; Also known as 3(2H)-ISOXAZOLONE, 5-(AMINOMETHYL)-
P008	4-AMINOPYRIDINE; Also known as 4-PYRIDINAMINE
P010	ARSENIC ACID H ₃ ASO ₄
P011	ARSENIC OXIDE AS ₂ O ₅ ; Also known as ARSENIC PENTOXIDE
P012	ARSENIC OXIDE AS ₂ O ₃ ; Also known as ARSENIC TRIOXIDE
P013	BARIUM CYANIDE
P014	BENZENETHIOL; Also known as THIOPHENOL
P015	BERYLLIUM
P016	DICHLOROMETHYL ETHER; Also known as METHANE, OXYBIS[CHLORO-
P017	BROMOACETONE; Also known as 2-PROPANONE, 1-BROMO-
P018	BRUCINE
P020	DIOSEB; Also known as PHENOL, 2-(1-METHYLPROPYL)-4,6-DINITRO-
P021	CALCIUM CYANIDE; Also known as CALCIUM CYANIDE CA(CN) ₂
P022	CARBON DISULFIDE
P023	ACETALDEHYDE, CHLORO-; Also known as CHLOROACETALDEHYDE
P024	BENZENAMINE, 4-CHLORO-; Also known as P-CHLORANILINE
P026	1-(O-CHLOROPHENYL)THIOUREA; Also known as THIOUREA, (2-CHLOROPHENYL)-
P027	PROPANENITRILE, 3-CHLORO-; Also known as 3-CHLOROPROPIONITRILE
P028	BENZENE, (CHLOROMETHYL)-; Also known as BENZYL CHLORIDE
P029	COPPER CYANIDE; Also known as COPPER CYANIDE CU(CN)
P030	CYANIDES (SOLUBLE CYANIDE SALTS), NOT OTHERWISE SPECIFIED
P031	CYANOGEN; Also known as ETHANEDINITRILE
P033	CYANOGEN CHLORIDE; Also known as CYANOGEN CHLORIDE (CN)CL

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
P034	2-CYCLOHEXYL-4,6-DINITROPHENOL; Also known as PHENOL, 2-CYCLOHEXYL-4,6-DINITRO-
P036	ARSONOUS DICHLORIDE, PHENYL-; Also known as DICHLOROPHENYLARSINE
P037	DIELDRIN; Also known as 2,7:3,6-DIMETHANONAPHTH[2,3-B]OXIRENE, 3,4,5,6,9,9-HEXACHLORO-1A,2,2A,3,6,6A,7,7A-OCTAHYDRO-, (1AALPHA, 2BETS, 2AALPHA, 3BETAK, 6BETA, 6AALPHA, 7BETA, 7AALPHA)-
P038	ARSINE, DIETHYL-; Also known as DIETHYLARSINE
P039	PHOSPHORODITHIOIC ACID, O,O-DIETHYL S-[2-(ETHYLTHIO)ETHYL]ESTER; Also known as DISULFOTON
P040	O,O-DIETHYL O-PYRAZINYL PHOSPHOROTHIOATE; Also known as PHOSPHOROTHIOIC ACID, O, O-DIMETHYL O-(4 NITROPHENYL) ESTER
P041	PHOSPHORIC ACID, DIETHYL 4-NITROPHENYL ESTER; Also known as DIETHYL-P-NITROPHENYL PHOSPHATE
P042	1,2-BENZENEDIOL, 4-[HYDROXY-2-(METHYLAMINO)ETHYL]-,(R)-; Also known as EPINEPHRINE
P043	DIISOPROPYLFLUOROPHOSPHATE (DFP); Also known as PHOSPHOROFLUORIDIC ACID, BIS (1-METHYLETHYL)ESTER
P044	DIMETHOATE; Also known as PHOSPHORODITHIOIC ACID,O, O-DIMETHYL S-[2-(METHYLAMINO)-2-OXOETHYL]ESTER
P045	2-BUTANONE, 3, 3-DIMETHYL-1-(METHYITHIO)-,O-[METHYLOAMINO)CARBONYL]OXIME; Also known as THIOFANOX
P046	BENZENEETHANAMINE, ALPHA,ALPHA-DIMETHYL-; Also known as ALPHA,ALPHA-DIMETHYLPHENETHYLAMINE
P047	4,6-DINITRO-O-CRESOL, & SALTS; Also known as PHENOL,2-METHYL-4,6-DINITRO-, & SALTS
P048	2,4-DINITROPHENOL; Also known as PHENOL, 2,4-DINITRO-
P049	DITHIOBIURET; Also known as THIOIMIDODICARBONIC DIAMIDE [H ₂ N)C(S)] ₂ NH
P050	ENDOSULFAN; Also known as 6M9-METHANO-2,4,3-BENZODIOXATHIEPIN, 6,7,8,9,10,1K0-HEXACHLORO-1,5,5A,6,9,91-HEXAHYDRO-,3-OXIDE
P051	2,7:3,6-DIMETHANONAPHTH [2,3-B]OXIRENE, 3,4,5,6,9,9-HEXACHLORO-1A,2,2A,3,6,6A,7,7A-OCTAHYDRO-, (1AALPHA, 2BETA, 2ABETA, 3ALPHA, 6ALPHA, 6ABETA, 7BETA, 7AALPHA)-, & METABOLITES; Also known as ENDRIN; Also known as ENDRIN, & METABOLITES
P054	AZIRIDINE; Also known as ETHYLENEIMINE
P056	FLUORINE
P057	ACETAMIDE, 2-FLUORO-; Also known as FLUOROACETAMIDE
P058	ACETIC ACID, FLUORO-,SODIUM SALT; Also known as FLUOROACETIC ACIDE, SODIUM SALT
P059	HEPTACHLOR; Also known as

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
	4,7-METHANO-1H-INDENE, 1,4,5,6,7,8,-HEPTACHLORO-3A,4,7,7A-TETRAHYDRO-
P060	1,4,5,8-DIMETHANONAPHTHALENE,1,2,3,4,10,10-HEXA- CHLORO-1,4,4A,5,7,8,8A- HEXAHYDRO-(1ALPHA, 4ALPHA, 4ABETA, 5BETA,8BETA,8ABETA)-; Also known as ISODRIN
P062	HEXAETHYL TETRAPHOSPHATE; Also known as TETRAPHOSPHORIC ACID, HEXAETHYL ESTER
P063	HYDROCYANIC ACID; Also known as HYDROGEN CYANIDE
P064	METHANE, ISOCYANATO-
P066	ETHANIMIDOTHIOIC ACID, N-[[[(METHYLAMINO)CARBONYL]OXY]-, METHYL ESTER; Also known as METHOMYL
P067	AZINIDINE, 2-METHYL; Also known as 1,2-PROPYLENIMINE
P068	HYDRAZINE, METHYL-; Also known as METHYL HYDRAZINE
P069	2-METHYLLACTONITRILE; Also known as PROPANENITRILE, 2-HYDROXY-2-METHYL-
P070	ALDICARB; Also known as PROPANAL, 2-METHYL-2-(METHYLTHIO)-, O-[(METHYLAMINO)CARBONYL]OXIME
P071	METHYL PARATHION; Also known as PHOSPHOROTHIOIC ACID, O, O,-DIMETHYL O-(4-NITROPHENYL)ESTER
P072	ALPHA-NAPHTHYLTHIOUREA; Also known as THIOUREA, 1-NAPHTHALENYL-
P073	NICKEL CARBONYL; Also known as NICKEL CARBONYL NI(CO) ₄ , (T-4)-
P074	NICKEL CYANIDE; Also known as NICKEL CYNAIDE NI(CN) ₂
P075	NICOTINE, & SALTS; Also known as PYRIDINE, 3-(1-METHYL-2-PYRROLIDINYL)-, (S)-, & SALTS
P077	BENZENAMINE, 4-NITRO-; Also known as P-NITROANILINE
P078	NITROGEN DIOXIDE; Also known as NITROGEN OXIDE NO ₂
P082	METHANAMINE, N-METHYL-N-NITROSO-; Also known as N-NITROSODIMETHYLAMINE
P084	N-NITROSOMETHYLVINYLAMINE; Also known as VINYLAMINE, N-METHYL-N-NITROSO-
P085	DIPHOSPHORAMIDE, OCTAMETHYL-; Also known as OCTAMETHYLPYROPHOSPHORAMIDE
P087	OSMIUM OXIDE OSO ₄ , (T-4)-; Also known as OSMIUM TETROXIDE
P088	ENDOTHALL; Also known as 7-OXABICYCLO[2.2.1]HEPTANE-2,3-DICARBOXYLIC ACID
P089	PARATHION; Also known as PHOSPHORIC ACID, O,O-DIETHYL O-(4- NITROPHENYL)ESTER
P092	MERCURY, (ACETATO-O)PHENYL-; Also known as PHENYLMERCURY ACETATE
P093	PHENYLTHIOUREA; Also known as THIOUREA, PHENYL-
P094	PHORATE; Also known as PHOSPHORODITHIOIC ACID, O,O-DIETHYL; Also known as S-[ETHYLTHIO)METHYL] ESTER
P095	CARBONIC DICHLORIDE; Also known as PHOSGENE
P096	HYDROGEN PHOSPHIDE; Also known as PHOSPHINE
P097	FAMPHUR; Also known as

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
	PHOSPHOTHIOIC ACID, O-[4-[(DIMETHYLAMINO)SULFONYL]PHENYL] O,O-DIMETHYL ESTER
P098	POTASSIUM CYANIDE
P099	ARGENTATE(1-), BIS(CYANO-C)-, POTASSIUM; Also known as POTASSIUM SILVER CYANIDE
P101	ETHYL CYANIDE; Also known as PROPANENITRILE
P102	PROPARGYL ALCOHOL; Also known as 1-PROPYN-1-OL
P103	SELENOUREA
P104	SILVER CYANIDE
P105	SODIUM AZIDE
P108	STRYCHNIDIN-10-ONE, & SALTS; Also known as STRYCHNINE, & SALTS
P109	TETRAETHYLDITHIOPYROPHOSPHATE; Also known as THIODIPHOSPHIRIC ACID, TETRAETHYL ESTER
P110	TETRAETHYL LEAD
P113	THALLIUM OXIDE TL ₂ O ₃
P114	THALLIUM(L) SELENITE
P115	THALLIUM(L) SULFATE
P116	THIOSEMICARBAZIDE
P118	TRICHLOROMETHANETHIOL
P119	VANADIC ACID, AMMONIUM SALT
P120	VANADIUM PENTOXIDE
P121	ZINC CYANIDE
P123	TOXAPHENE
U001	ACETALDEHYDE (I); Also known as ETHANAL (I)
U002	ACETONE (I); Also known as 2-PROPANONE (I)
U003	ACETONITRILE (I,T)
U004	ACETONITRILE (I,T)
U005	2, ACETYLAMINOFLUORENE; Also known as ACETAMIDE, N-9H-FLUOREN-2-YL-
U007	ACRYLAMIDE; Also known as 2-PROPENAMIDE
U008	ACRYLIC ACID (I); Also known as 2-PROPENOIC ACID (I)
U009	ACRYLONITRILE; Also known as 2-PROPENENITRILE
U010	AZIRINO[2',3':3,4]PYRROLO[1,2-a]INDOLE-4,7-DIONE,6-AMINO-8- [[[AMINOCARBONYLOXY]METHYL]-1,1a,2,8,8a,8b-HEXAHYDRO-8a-METHOXY-5-METHYL-, [1aS-(1AALPHA, 8BETA, 8AALPHA, 8BALPHA)]-; Also known as MITOMYCIN C
U011	AMITROLE; Also known as 1H-1,2,-TRIAZOL-3-AMINE
U012	ANILINE (I,T); Also known as BENZENAMINE (I,T)
U014	AURAMINE; Also known as BENZENAMINE, 4,4'-CARBONIMIDOYLBIS[N,N-DIMETHYL-

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
U015	AZASERINE; Also known as L-SERINE, DIAZOACETATE (ESTER)
U016	BENZ[C]ACRIDINE
U017	BENZAL CHLORIDE; Also known as BENZENE,(DICHLOROMETHYL)-
U018	BENZ[A]ANTHRACENE
U019	BENZENE (I,T)
U021	BENZIDINE; Also known as [1,1'-BIPHENYL]-4,4'-DIAMINE
U022	BENZO[A]PYRENE
U024	DICHLOROMETHOXY ETHANE; Also known as ETHANE, 1,1'-[METHYLENEBIS(OXY)]BIS[2-CHLORO-
U025	DICHLOROETHYL ETHER; Also known as ETHANE,1,1'-OXYBIS[2-CHLORO-
U026	CHLORNAPHAZIN; Also known as NAPHTHALENAMINE, N,N'-BIS(2-CHLOROETHYL)-
U027	DICHLOROISOPROPYL ETHER; Also known as PROPANE, 2,2'-OXYBIS[2-CHLORO-
U028	1,2-BENZENEDICARBOXYLIC ACID, BIS(2-ETHYLHEXYL) ESTER; Also known as DIETHYLHEXYL PHTHALATE
U029	METHANE, BROMO-; Also known as METHYL BROMIDE
U030	BENZENE, 1-BROMO-4-PHENOXY-; Also known as 4-BROMOPHENYL PHENYL ETHER
U031	1-BUTANOL (I); Also known as N-BUTYL ALCOHOL (I)
U032	CHROMIC ACID H ₂ CRO ₄ , CALCIUM SALT; Also known as CALCIUM CHROMATE
U034	CHLORAL; Also known as ACETALDEHYDE, TRICHLORO-
U035	CHLORAMBUCIL; Also known as BENZENE BUTANOIC ACID, 4-[BIS(2-CHLOROETHYL)AMINO]-
U036	CHLORDANE, ALPHA & GAMMA ISOMERS; Also known as 4,7-METHANO-1H-INDENE, 1,2,4,5,6,7,8,8-OCTACHLORO-2,3,3A,4,7,7A-HEXAHYDRO-
U037	CHLOROBENZENE; Also known as BENZENE, CHLORO-
U038	CHLOROBENZILATE; Also known as BENZENEACETIC ACID, 4-CHLORO-ALPHA- (4-CHLOROPHENYL)-ALPHA-HYDROXY-, ETHYL ESTER
U039	P-CHLORO-M-CRESOL; Also known as PHENOL, 4-CHLORO-3-METHYL-
U041	EPICHLOROHYDRIN; Also known as OXIRANE, (CHLOROMETHYL)-
U042	2-CHLOROETHYL VINYL ETHER; Also known as ETHENE, (2-CHLOROETHOXY)-
U043	VINYL CHLORIDE; Also known as ETHENE, CHLORO-
U044	CHLOROFORM; Also known as METHANE, TRICHLORO-
U045	METHANE, CHLORO- (I,T); Also known as METHYL CHLORIDE (I,T)
U046	CHLOROMETHYL METHYL ETHER; Also known as METHANE, CHLOROMETHOXY-
U047	BETA-CHLORONAPHTHALENE; Also known as NAPHTHALENE, 2-CHLORO-
U048	O-CHLOROPHENOL; Also known as PHENOL, 2-CHLORO-
U049	4-CHLORO-O-TOLUIDINE, HYDROCHLORIDE; Also known as BENZENAMINE, 4-CHLORO-2-METHYL, HYDROCHLORIDE

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
U050	CHRYSENE
U051	CREOSOTE
U052	CRESOL (CRESYLIC ACID); Also known as PHENOL, METHYL-
U053	CROTONALDEHYDE; Also known as 2-BUTENAL
U055	CUMENE (I); Also known as BENZENE, (1-METHYLETHYL)- (I)
U056	BENZENE, HEXAHYDRO- (I); Also known as CYCLOHEXANE (I)
U057	CYCLOHEXANONE (I)
U058	CYCLOPHOSPHAMIDE; Also known as 2H-1,3,2-OXAZAPHOSPHORIN-2-AMINE, N,N-BIS (2-CHLOROETHYL)TETRAHYDRO-, 2- OXIDE
U059	DAUNOMYCIN; Also known as 5,12-NAPHTHACENEDIONE, 8-ACETYL-10-[(3-AMINO-2,3,6-TRIDEOXY)-ALPHS-L-LYXO- HEXOPYRANOSY)OXY]-7,8,9,10-TETRAHYDRO-6,8,11-TRIHYDROXY-1-METHOXY-, (8S-CIS)-
U060	DDD; Also known as BENZENE, 1,1'-(2,2-DICHLOROETHYLIDENE)BIS[4-CHLORO-
U061	DDT; Also known as BENZENE, 1,1'-(2,2,2-TRICHLOROETHYLIDENT)BIS[4-CHLORO-
U062	DIALATE; Also known as CARBAMOTHIOIC ACID, BIS(1-METHYLETHYL)-, S-(2,3-DICHLORO-2-PROPENYL) ESTER
U063	DIBENZ[A,H]ANTHRACENE
U064	DIBENZO[A,I]PYRENE; Also known as BENZO[RST]PENTAPHENE
U066	1,2-DIBROMO-3-CHLOROPROPANE; Also known as PROPANE, 1,2-DIBROMO-3- CHLORO-
U067	ETHANE, 1,2-DIBROMO-; Also known as ETHYLENE DIBROMIDE
U068	METHANE, DIBROMO-; Also known as METHYLENE BROMIDE
U069	DIBUTYL PHTHALATE; Also known as 1,2-BENZENEDICARBOXYLIC ACID, DIBUTYL ESTER
U070	o-DICHLOROBENZENE; Also known as BENZENE, 1,2-DICHLORO-
U071	m-DICHLOROBENZENE; Also known as BENZENE, 1,3-DICHLORO-
U072	p-DICHLOROBENZENE; Also known as BENZENE, 1,4-DICHLORO-
U073	3,3'-DICHLOROBENZIDINE; Also known as [1,1'-BIPHENYL]-4,4'-DIAMINE, 3,3'DICHLORO-
U074	1,4-DICHLORO-2-BUTENE (I,T); Also known as 2-BUTENE, 1,4-DICHLORO- (I,T)
U075	DICHLORODIFLUOROMETHANE; Also known as METHANE, DICHLORODIFLUORO-
U076	ETHANE, 1,1-DICHLORO-; Also known as ETHYLIDENE DICHLORIDE
U077	ETHANE, 1,2-DICHLORO-; Also known as ETHYLENE DIBROMIDE
U078	1,1-DICHLOROETHYLENE; Also known as ETHENE, 1,1-DICHLORO-
U079	1,2-DICHLOROETHYLENE; Also known as ETHENE, 1,2-DICHLORO-, (E)
U080	METHANE, DICHLORO-; Also known as METHYLENE CHLORIDE

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
U081	2,4-DICHLOROPHENOL; Also known as PHENOL, 2,4-DICHLORO-
U082	2,6-DICHLOROPHENOL; Also known as PHENOL, 2,6-DICHLORO-
U083	PROPANE, 1,2-DICHLORO-; Also known as PROPYLENE DICHLORIDE
U084	1,3-DICHLOROPROPENE; Also known as 1-PROPENE, 1,3-DICHLORO-
U085	1,2:3,4--DIEPOXYBUTANE (I,T); Also known as 2,2'-BIOXIRANE
U086	N,N'-DIETHYLHYDRAZINE; Also known as HYDRAZINE, 1,2,-DIETHYL-
U087	O,O-DIETHYL S-METHYL DITHIOPHOSPHATE; Also known as PHOSPHORODITHIOIC ACID, O,O-DIETHYL S-METHYL ESTER
U088	DIETHYL PHTHALATE; Also known 1,2-BENZENEDICARBOXYLIC ACID, DIETHYL ESTER
U089	DIETHYLSTILBESTEROL; Also known as PHENOL, 4,4'-(1,2-DIETHYL-1,2- ETHENEDIYL)BIS-, (E)
U090	DIHYDROSAFROLE; Also known as 1,3-BENZODIOXOLE, 5-PROPYL-
U091	3,3'-DIMETHOXYBENZIDINE; Also known as [1,1'-BIPHENYL]-4,4'-DIAMINE, 3,3'DIMETHOXY-
U092	DIMETHYLAMINE (I); Also known as METHANAMINE, N-METHYL- (I)
U093	BENZENAMINE, N,N-DIMETHYL-4-(PHENYLAZO)-; Also known as P-DIMETHYLAMINOAZOBENZENE
U094	BENZ[A]ANTHRACENE, 7,12-DIMETHYL-; Also known as 7,12- DIMETHYLBENZ[A]ANTHRACENE
U095	3,3'-DIMETHYLBENZIDINE; Also known as [1,1'-BIPHENYL]-4,4'-DIAMINE, 3,3'DIMETHYL-
U097	DIMETHYLCARBAMOYL CHLORIDE; Also known as CARBAMIC CHLORIDE, DIMETHYL-
U098	1,1-DIMETHYLHYDRAZINE; Also known as HYDRAZINE, 1,1-DIMETHYL-
U099	1,2-DIMETHYLHYDRAZINE; Also known as HYDRAZINE, 1,2,-DIMETHYL-
U101	2,4-DIMETHYLPHENOL; Also known as PHENOL, 2,4-DIMETHYL-
U102	DIMETHYL PHTHALATE; Also known as 1,2-BENZENEDICARBOXYLIC ACID, DIMETHYL ESTER
U103	DIMETHYL SULFATE; Also known as SULFURIC ACID, DIMETHYL ESTER
U105	2,4-DINITROTOLUENE; Also known as BENZENE, 1-METHYL-2,4-DINITRO-
U106	2,6-DINITROTOLUENE; Also known as BENZENE, 2-METHYL-1,3-DINITRO-
U107	DI-N-OCTYL PHTHALATE; Also known as 1,2-BENZENEDICARBOXYLIC ACID, DIOCTYL ESTER
U108	1,4-DIETHYLENEOXIDE; Also known as 1,4-DIOXANE
U109	1,2-DIPHENYLHYDRAZINE; Also known as HYDRAZINE, 1,2-DIPHENYL-
U110	DIPROPYLAMINE (I); Also known as 1-PROPANAMINE, N-PROPYL- (I)
U111	DI-N-PROPYLNITROSAMINE; Also known as 1-PROPANAMINE, N-NITROSO-N-PROPYL-
U112	ACETIC ACID ETHYL ESTER (I); Also known as ETHYL ACETATE (I)
U113	ETHYL ACRYLATE (I); Also known as 2-PROPENOIC ACID, ETHYL ESTER (I)

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
U114	ETHYLENEBISDITHIOCARBAMIC ACID, SALTS & ESTERS; Also known as CARBAMODITHIOIC ACID, 1,2- ETHANEDIYLBIS-, SALTS & ESTERS
U115	ETHYLENE OXIDE (I,T); Also known as OXIRANE (I,T)
U116	ETHYLENETHIOUREA; Also known as 2-IMIDAZOLIDINETHIONE
U117	ETHANE, 1,1'-OXYBIS-(I); Also known as ETHYL ETHER (I)
U118	ETHYL METHACRYLATE; Also known as 2-PROPENOIC ACID, 2-METHYL-, ETHYL ESTER
U119	ETHYL METHANESULFONATE; Also known as METHANESULFONIC ACID, ETHYL ESTER
U120	FLUORANTHENE
U121	TRICHLOROMONOFUOROMETHANE; Also known as METHANE, TRICHLOROFLUORO-
U122	FORMALDEHYDE
U124	FURAN (I); Also known as FURFURAN (I)
U125	2-FURANCARBOXALDEHYDE (I); Also known as FURFURAL (I)
U126	GLYCIDYLALDEHYDE; Also known as OXIRANECARBOXYALDEHYDE
U127	HEXACHLOROBENZENE; Also known as BENZENE, HEXACHLORO-
U128	HEXACHLOROBUTADIENE; Also known as 1,3-BUTADIENE, 1,1,2,3,4,4-HEXACHLORO-
U129	LINDANE; Also known as CYCLOHEXANE, 1,2,3,4,5,6- HEXACHLORO-, (1ALPHA, 2ALPHA, 3BETA, 4ALPHA, 5ALPHA, 6BETA)-
U130	HEXACHLOROCYCLOPENTADIENE; Also known 1,3-CYCLOPENTADIENE, 1,2,3,4,5,5-HEXACHLORO-
U131	HEXACHLOROETHANE; Also known as ETHANE, HEXACHLORO-
U132	HEXACHLOROPHENE; Also known as PHENOL, 2,2'-METHYLENEBIS[3,4,6-TRICHLORO-
U135	HYDROGEN SULFIDE; Also known HYDROGEN SULFIDE H ₂ S
U136	ARSINIC ACID, DIMETHYL-; Also known as CACODYLIC ACID
U137	INDENO[1,2,3-CD]PYRENE
U138	METHANE, IODO-; Also known as METHYL IODIDE
U140	ISOBUTYL ALCOHOL, (I,T); Also known as 1-PROPANOL, 2-METHYL-, (I,T)
U141	ISOSAFROLE; Also known as 1,3-BENZODIOXOLE, 5-(1-PROPENYL)-
U142	KEPONE; Also known as 1,3,4-METHENO-2H-CYCLOBUTA[CD]PENTALEN-2-ONE, 1,1A,3,3A,4,5,5A,5B,6- DECACHLOROOCCTAHYDRO-
U143	LASIOCARPINE; Also known as 2-BUTENOIC ACID, 2-METHYL-, 7-[2,3-DIHYDROXY-2-(1-METHOXYETHYL)-3-METHYL-1- OXOBUTOXY]METHYL]-2,3,5,6A-TETRAHYDRO-1H-PYRROLIZIN-1-YL ESTER,[1S-1ALPHA(Z),7(2S*,3R*),7AALPHA]]-
U144	ACETIC ACID, LEAD(2+) SALT; Also known as LEAD ACETATE
U145	LEAD PHOSPHATE; PHOSPHORIC ACID, LEAD(2+) SALT (2:3)
U146	LEAD, BIS(ACETATO-O) TETRAHYDROXYTRI-; Also known as LEAD SUBACETATE

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
U147	MALEIC ANHYDRIDE; Also known as 2,5-FURANDIONE
U148	MALEIC HYDRAZIDE; Also known as 3,6-PYRIDAZINEDIONE, 1,2-DIHYDRO-
U149	MALONONITRILE; Also known as PROPANEDINITRILE
U150	MELPHALAN; Also known as L-PHENYLALANINE, 4-[BIS(2-CHLOROETHYL)AMINO]-
U151	MERCYR
U152	METHACRYLONITRILE (I,T); Also known as 2-PROPENENITRILW, 2-METHYL- (I,T)
U153	METHANETHIOL (I,T); Also known as THIOMETHANOL (I,T)
U154	METHANOL (I); Also known as METHYL ALCOHOL (I)
U155	METHAPYRILENE; Also known 1,2-ETHANEDIAMINE, N,N- DIMETHYL-N'-W-PYRIDINYL-N'-(2- THIENYLMETHYL)-
U156	METHYL CHLOROCARBONATE (I,T); Also known CARBONCHLORIDIC ACID, METHYL ESTER (I,T)
U157	BENZ[I]ACEANTHRYLENE, 1,2-DIHYDRO-3-METHYL-; Also known as 3-METHYLCHOLANTHRENE
U158	BENZENAMINE, 4,4'METHYLENEBIS[2-CHLORO-; Also known as 4,4'-METHYLENEBIS(2-CHLOROANILINE)
U159	METHYL ETHYL KETONE (MEK) (I,T); Also known as 2-BUTANONE (I,T)
U161	METHYL ISOBUTYL KETONE (I); Also known as 4-METHYL-2-PENTANONE (I) and PENTANOL, 4-METHYL-
U162	METHYL METHACRYLATE (I,T); Also known as 2-PROPENOIC ACID, 2-METHYL-, METHYL ESTER (I,T)
U163	MNNG; Also known as GUANIDINE, N-METHYL-N'-NITRO-N- NITROSO-
U164	METHYLTHIOURACIL; Also known as 4(1H)-PYRIMIDINONE, 2,3-DIHYDRO-6-METHYL-2-THIOXO-
U165	NAPHTHALENE
U166	1,4-NAPHTHALENEDIONE; Also known as 1,4-NAPHTHOQUINONE
U167	1-NAPHTHALENAMINE; Also known as ALPHA-NAPHTHYLAMINE
U168	2-NAPHTHALENAMINE; Also known as BETA-NAPHTHYLAMINE
U169	NITROBENZENE (I,T); Also known as BENZENE, NITRO-
U170	P-NITROPHENOL; Also known as PHENOL, 4-NITRO
U171	2-NITROPROPANE (I,T); Also known as PROPANE, 2-NITRO (I,T)
U172	N-NITROSODI-N-BUTYLAMINE; Also known as 1-BUTANAMINE, N-BUTYL-N-NITROSO-
U173	N-NITROSODIETHANOLAMINE; Also known as ETHANOL, 2,2'-(NITROSOIMINO)BIS-
U174	N-NITROSODIETHYLAMINE; Also known as ETHANAMINE, N-ETHYL-N-NITROSO-
U176	N-NITROSO-N-ETHYLUREA; Also known as UREA, N-ETHYL-N-NITROSO-
U177	N-NITROSO-N-METHYLUREA; Also known as UREA, N-METHYL-N-NITROSO-
U178	N-NITROSO-N-METHYLURETHANE; Also known as CARBAMIC ACID, METHYLNITROSO-,ETHYL ESTER

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
U179	N-NITROSOPIPERIDINE; Also known as PIPERIDINE, 1-NITROSO-
U180	N-NITROSOPYRROLIDINE; Also known as PYRROLIDINE, 1-NITROSO-
U181	BENZENAMINE, 2-METHYL-5-NITRO-; Also known as 5-NITRO-O-TOLUIDINE
U182	PARALDEHYDE; Also known as 1,3,5-TRIOXANE, 2,4,6- TRIMETHYL-
U183	PENTACHLOROBENZENE; Also known as BENZENE, PENTACHLORO-
U184	PENTACHLOROETHANE; Also known as ETHANE, PENTACHLORO-
U185	PENTACHLORONITROBENZENE (PCNB); Also known as BENZENE, PENTACHLORONITRO-
U186	1,3-PENTADIENE (I); Also known as 1-METHYLBUTADIENE (I)
U187	ACETAMIDE, N-(4-ETHOXYPHENYL)-; Also known as PHENACETIN
U188	PHENOL
U190	PHTHALIC ANHYDRIDE; Also known as 1,3-ISOBENZOFURANDIONE
U191	2-PICOLINE; Also known as PYRIDINE, 2-METHYL-
U192	BENZAMIDE,3,5-DICHLORO-N-(1,1-DIMETHYL-2-PROPYNYL)-; Also known as PRONAMIDE
U193	1,3-PROPANE SULTONE; Also known as 1,2-OXATHIOLANE, 2,2-DIOXIDE
U194	1-PROPANAMINE (I,T); Also known as N-PROPYLAMINE (I,T)
U196	PYRIDINE
U197	P-BENZOQUINONE; Also known as 2,5-CYCLOHEXADIENE-1,4-DIONE
U200	RESERPINE; Also known as YOHIMBAN-16-CARBOXYLIC ACID, 11,17-DIMETHOXY-18-[(3,4,5-TRIMETHOXYBENZOYL)OXY]-, METHYL ESTER, (3BETA, 16BETA, 17ALPHA, 18BETA, 20ALPHA)-
U201	RESORCINOL; Also known as 1,3-BENZENEDIOL
U202	SACCHARIN, & SALTS; Also known as 1,2-BENZISOTHIAZOL-3(2H)-ONE, 1,1-DIOXIDE, & SALTS
U203	SAFROLE; Also known as 1,3-BENZODIOXOLE, 5-(2- PROPENYL)-
U204	SELENIOUS ACID; Also known as SELENIUM DIOXIDE
U206	STREPTOZOTOCIN; Also known as GLUCOPYRANOSE, 2-DEOXY-2-(3-METHYL-3-NITROSOUREIDO)-, D-D-GLUCOSE, 2-DEOXY-2-[[[(METHYLNITROSOAMINO)-CARBONYL]AMINO]-
U207	1,2,4,5-TETRACHLOROBENZENE; Also known as BENZENE, 1,2,4,5-TETRACHLORO-
U208	1,1,1,2-TETRACHLOROETHANE; Also known as ETHANE, 1,1,1,2-TETRACHLORO-
U209	1,1,2,2-TETRACHLOROETHANE; Also known as ETHANE, 1,1,2,2-TETRACHLORO-
U210	TETRACHLOROETHYLENE; Also known as ETHENE, TETRACHLORO-
U211	CARBON TETRACHLORIDE; Also known as METHANE, TETRACHLORO-
U213	TETRAHYDROFURAN (I); Also known as FURAN, TETRAHYDRO-(I)
U214	ACETIC ACID, THALLIUM(1+) SALT; Also known as THALLIUM(I) ACETATE

Exhibit C -- HAZARDOUS WASTES RECEIVED AT SIEMENS WATER TECHNOLOGY CORP.

EPA WASTE CODE	WASTE DESCRIPTION
U215	THALLIUM(I) CARBONATE; Also known as CARBONIC ACID, DITHALLIUM(1+) SALT
U216	THALLIUM(I) CHLORIDE; Also known as THALLIUM CHLORIDE TLCL
U217	THALLIUM(I) NITRATE; Also known as NITRIC ACID, THALLIUM(1+) SALT
U218	THIOACETAMIDE; Also known as ETHANETHIOAMIDE
U219	THIOUREA
U220	TOLUENE; Also known as BENZENE, METHYL-
U221	TOLUENEDIAMINE; Also known as BENZENEDIAMINE, AR-METHYL-
U222	BENZENAMINE, 2-METHYL-, Also known as HYDROCHLORIDE O-TOLUIDINE HYDROCHLORIDE
U225	BROMOFORM; Also known as METHANE, TRIBROMO-
U226	ETHANE, 1,1,1-TRICHLORO-; Also known as METHYL CHLOROFORM
U227	1,1,2-TRICHLOROETHANE; Also known as ETHANE, 1,1,2-TRICHLORO-
U228	TRICHLOROETHYLENE; Also known as ETHENE, TRICHLORO-
U235	TRIS(2,3-DIBROMOPROPYL) PHOSPHATE; Also known as 1-PROPANOL, 2,3-DIBROMO-, PHOSPHATE (3:1)
U236	TRYPAN BLUE; Also known as 2,7-NAPHTHALENEDISULFONIC ACID, 3,3'-[(3,3'-DIMETHYL[1,1'-BIPHENYL]-4,4'-DIYL)BIS(AZO)BIS[5-AMINO-4-HYDROXY]-, TETRASODIUM SALT
U237	URACIL MUSTARD; Also known as 2,4-(1H,3H)-PYRIMIDINEDIONE, 5-[BIS(2-CHLOROETHYL)AMINO]-
U238	CARBAMIC ACID, ETHYL ESTER; Also known as ETHYL CARBAMATE (URETHANE)
U239	XYLENE (I); Also known as BENZENE, DIMETHYL- (I,T)
U240	ACETIC ACID, 92,4-DICHLOROPHENOXY)-, SALTS & ESTERS; Also known as 2,4-D, SALTS & ESTERS
U243	HEXACHLOROPROPENE; Also known as 1-PROPENE, 1,1,2,3,3,3- HEXACHLORO-
U244	THIOPEROXYDICARBONIC DIAMIDE [(H ₂ N)C(S)] ₂ S ₂ , TETRAMETHYL-; Also known as THIRAM
U246	CYANOGEN BROMIDE (CN)Br
U247	BENZENE, 1,1'(2,2,2-TRICHLOROETHYLIDENE)BIS[4-METHOXY-; Also known as METHOXYCHLOR
U248	WARFARIN, & SALTS, WHEN PRESENT AT CONCENTRATIONS OF 0.3% OR LESS; Also known as 2H-1-BENZOPYRAN-2-ONE, 4- HYDROXY-3-(3-OXO-1-PHENYL-BUTYL)-, & SALTS, WHEN PRESENT AT CONCENTRATIONS OF 0.3% OR LESS
U249	ZINC PHOSPHIDE Zn ₃ P ₂ WHEN PRESENT AT CONCENTRATIONS OF 10% OR LESS
U328	BENZENAMINE, 2-METHYL-; Also known as o-TOLUIDINE
U353	BENZENAMINE, 4-METHYL-; Also known as p-TOLUIDINE
U359	ETHANOL, 2-ETHOXY-; Also known as ETHYLENE GLYCOL MONOETHYL ETHER

Exhibit C - Hazardous Waste Characteristics

Table 2 – Spent Activated Carbon Organic Constituents

Exhibit C

Spent Activated Carbon Organic Constituent Data Summary				
Constituent	CAS NO.	Organics (lb constituent per lb spent activated carbon)		
		Minimum	Maximum	Average
1-Butanol	71-36-3	8.67E-04	8.67E-04	8.67E-04
1-Hexane	110-54-3	3.86E-04	8.45E-02	4.24E-02
1,1 Dichloroethane	75-34-3	9.00E-09	3.20E-02	9.71E-04
1,1 Dichloroethene	75-35-4	2.50E-10	2.94E-01	2.51E-03
1,1,1 Trichloroethane	71-55-6	2.50E-09	3.43E+00	1.31E-02
1,1,2 Trichloroethane	79-00-5	5.00E-07	1.41E-02	3.28E-03
1,1,2,2 Tetrachloroethane	79-34-5	1.45E-05	3.31E-04	2.29E-04
1,2 Dibromoethane	106-93-4	2.50E-08	1.98E-02	4.57E-03
1,2 Dichlorobenzene	95-50-1	2.05E-05	4.60E-03	9.99E-04
1,2 Dichloroethane	107-06-2	0.00E+00	1.39E-01	7.18E-03
1,2 Dichloroethene	540-59-0	2.50E-08	7.32E-03	2.13E-03
1,2 Dichloropropane	78-87-5	3.00E-09	5.30E-02	6.06E-03
1,2,3 Trichloropropane	96-18-4	3.72E-06	3.72E-06	3.72E-06
1,2,4 Trimethylbenzene	95-63-6	1.10E-07	4.80E-04	3.84E-04
1,2-Dichloroethene (cis)	156-59-2	1.00E-09	2.63E-03	1.39E-03
1,2-Dichloroethene (trans)	156-60-5	7.32E-05	5.44E-04	3.65E-04
1,3 Dichlorobenzene	541-73-1	7.40E-05	5.48E-04	1.70E-04
1,4 Dichlorobenzene	106-46-7	2.50E-08	3.44E-03	5.20E-04
2,3,4,6 Tetrachlorophenol	58-90-2	1.82E-05	1.82E-05	1.82E-05
2-Butanol	78-92-2	5.90E-04	5.90E-04	5.90E-04
2-Butoxyethanol	111-76-2	2.73E-03	2.73E-03	2.73E-03
2-ethyl-1-Methylbenzene	611-14-3	9.40E-05	9.40E-05	9.40E-05
2-methoxy-1-Propanol		6.24E-03	6.24E-03	6.24E-03
2-Methylnaphthalene	91-57-6	1.63E-05	1.34E-03	4.61E-04
2-Methylphenol (o-Cresol)	95-48-7	2.14E-05	2.14E-05	2.14E-05
3-/4-Methylphenol (m&p Cresol)	108-39-4 & 106-44-5	3.40E-05	3.40E-05	3.40E-05
4-ethyl-1-Methylbenzene		8.10E-05	8.10E-05	8.10E-05
Acenaphthalene	208-96-8	3.36E-05	6.26E-04	3.30E-04
Acenaphthene	83-32-9	2.81E-06	2.41E-05	1.09E-05
Acenaphthylene		1.18E-06	2.66E-06	1.92E-06
Acetone	67-64-1	4.51E-03	8.49E-03	6.50E-03
Acrylic Acid	79-10-7	2.50E-05	2.50E-05	2.50E-05
Acrylonitrile	107-13-1	9.30E-06	9.30E-06	9.30E-06
Aldrin	309-00-2	6.60E-07	6.60E-07	6.60E-07
Aniline	62-53-3	2.51E-05	4.26E-04	1.47E-04
Benzene	71-43-2	2.50E-10	9.25E-02	1.44E-03
Benzo(a)Anthracene	56-55-3	5.60E-07	2.10E-06	1.33E-06
Benzo(b)Fluoranthene	205-99-2	2.30E-07	4.00E-07	3.20E-07
Bromodichloromethane	75-27-46	3.00E-05	6.18E-04	4.06E-04
Butane	106-97-8	9.69E-06	9.69E-06	9.69E-06
Butyl Acetate	123-86-4	1.36E-02	1.36E-02	1.36E-02
Carbon Tetrachloride	56-23-5	3.00E-08	1.36E-02	5.39E-04
Chlorobenzene	108-90-7	2.50E-08	2.75E-03	4.76E-04
Chloroethane	75-00-3	3.89E-03	3.89E-03	3.89E-03
Chloroform	67-66-3	1.40E-08	2.08E-02	1.05E-02

Exhibit C

Spent Activated Carbon Organic Constituent Data Summary				
Constituent	CAS NO.	Organics (lb constituent per lb spent activated carbon)		
		Minimum	Maximum	Average
Chloromethane	74-87-3	2.06E-04	2.06E-04	2.06E-04
Chrysene	218-01-9	6.40E-07	6.40E-07	6.40E-07
Cresol	1319-77-3	5.10E-05	1.74E-04	1.13E-04
Cumene	98-82-8	5.78E-06	1.65E-03	4.37E-04
Dibenzofuran	132-64-9	7.66E-06	2.61E-05	1.69E-05
Dicyclopentadiene	77-73-6	6.06E-04	6.49E-02	1.68E-02
Dioxane	123-91-1	1.16E-04	9.20E-04	5.18E-04
Ethanol	64-17-5	3.56E-04	3.56E-04	3.56E-04
Ethyl Acetate	141-78-6	5.87E-03	5.87E-03	5.87E-03
Ethylbenzene	100-41-4	5.00E-10	2.30E-02	1.14E-03
Ethylene Glycol	107-21-1	2.94E-01	2.94E-01	2.94E-01
Fluoranthene	206-44-0	3.11E-06	2.90E-05	1.61E-05
Freon 113	76-13-1	1.10E-09	1.10E-09	1.10E-09
Isobutane	75-28-5	1.42E-02	1.42E-02	1.42E-02
Isopar C		1.27E-03	5.48E-02	2.80E-02
Isopropyl Alcohol	67-63-0	7.00E-03	7.00E-03	7.00E-03
Lindane	58-89-9	1.54E-09	6.70E-06	1.28E-06
m&p-Xylenes	108-38-3 &106-42-3	7.20E-08	2.89E-03	5.90E-04
Methanol	67-56-1	1.36E-01	1.36E-01	1.36E-01
Methoxychlor	72-43-5	2.80E-06	2.80E-06	2.80E-06
Methyl ethyl ketone	78-93-3	1.20E-08	4.10E-03	1.40E-03
Methyl Isobutyl ketone	108-10-1	5.00E-06	4.24E-02	2.94E-03
Methyl methacrylate	80-62-6	2.50E-08	2.50E-08	2.50E-08
methyl tert-butyl ether	1634-04-4	1.22E-07	4.66E-02	5.86E-03
Methylene chloride	75-09-2	1.90E-08	1.30E-01	1.63E-03
Methylnaphthalene	28804-88-8	3.54E-06	5.03E-06	4.29E-06
Naphthalene	91-20-3	6.00E-09	4.93E-03	4.31E-04
n-Hexane	110-54-3	5.51E-04	8.25E-03	4.40E-03
Nitrobenzene	98-95-3	6.99E-06	3.14E-02	4.50E-03
o-Xylene	95-47-6	2.50E-09	9.00E-05	1.22E-05
Pentachlorophenol	87-86-5	1.00E-06	3.97E-03	7.36E-04
Phenanthrene	85-01-8	3.20E-07	2.95E-05	1.08E-05
Phenol	108-95-2	2.00E-07	4.03E-03	1.27E-03
Polychlorinated Biphenyls	1336-36-3	8.00E-07	3.50E-06	2.15E-06
Propylbenzene	103-65-1	9.00E-05	9.00E-05	9.00E-05
Propylene glycol monomethyl ether acetate	107-98-2	1.45E-02	1.45E-02	1.45E-02
Propylene oxide	75-56-9	4.30E-09	4.00E-03	1.00E-03
Styrene	100-42-5	2.50E-08	3.97E-02	3.57E-03
Tetrachloroethane	630-20-6 & 79-34-5	2.96E-03	2.96E-03	2.96E-03
Tetrachloroethylene	127-18-4	0.00E+00	1.59E-01	1.84E-02
Tetrahydrofuran	109-99-9	4.16E-04	4.16E-04	4.16E-04
Toluene	108-88-3	1.60E-09	1.30E-01	8.68E-03
Trichloroethylene	79-01-6	2.50E-09	2.17E-01	2.24E-03

Exhibit C

Spent Activated Carbon Organic Constituent Data Summary				
Constituent	CAS NO.	Organics (lb constituent per lb spent activated carbon)		
		Minimum	Maximum	Average
Trichlorofluoromethane	75-69-4	1.00E-07	4.00E-02	1.42E-03
Triethylamine	121-44-8	9.54E-03	9.54E-03	9.54E-03
Tris(hydroxymethyl) Aminomethane		1.77E-02	1.77E-02	1.77E-02
Vinyl Chloride	75-01-4	2.30E-08	2.40E-05	2.58E-06
Xylene	1330-20-7	8.00E-10	1.59E-01	3.41E-03

All data reported on a dry carbon basis.

Exhibit C - Hazardous Waste Characteristics

Table 3 - Spent Activated Carbon Characterization

Exhibit C
Spent Activated Carbon Characterization Summary

Stream Type: Solid

Stream Name: Spent Activated Carbon

Feed Method: Dewatering screw, conveyor belt and rotary airlock

Constituent/Property	Units	Value	
		Typical	Range
Organic Constituents (a)			
Total organics	wt%	3.1	2 - 4
Inorganic Constituents			
Water	wt%	43.5	30 - 50
RCRA Metals (a)			
Antimony	mg/kg	<10	<10
Arsenic	mg/kg	2.8	1.2 - 19
Barium	mg/kg	38.3	1 - 110
Beryllium	mg/kg	0.5	<0.1 - 0.7
Cadmium	mg/kg	0.7	<0.5 - 6.9
Chromium	mg/kg	11	3.1 - 240
Chromium (VI)	mg/kg	<0.9	<1
Lead	mg/kg	2.7	<2 - 25
Mercury	mg/kg	0.1	0 - 0.5
Nickel	mg/kg	21.3	7.5 - 140
Selenium	mg/kg	<2	<1 - 3.9
Silver	mg/kg	1	<0.5 - 1.6
Thallium	mg/kg	10.7	<5 - 29
Other Metals (a)			
Cobalt	mg/kg	4.8	2.1 - 19
Copper	mg/kg	31.4	12 - 60
Manganese	mg/kg	223	54 - 590
Vanadium	mg/kg	6.2	3.7 - 7.9
Zinc	mg/kg	35.4	22 - 44
Elemental Composition (b)			
Carbon (from spent carbon)	wt%	94.5	70 - 99
Carbon (from organic adsorbed on carbon)	wt%	2.9	1.6 - 25
Hydrogen	wt%	0.4	0.2 - 8
Oxygen	wt%	0.5	0.3 - 5
Nitrogen	wt%	0.1	0.06 - 0.5
Sulfur	wt%	0	<0.1
Phosphorous	wt%	0	<0.1
Chlorine/chloride	wt%	1.5	0 - 5
Bromine/bromide	wt%	0	<0.1
Fluorine/fluoride	wt%	0	<0.1
Iodine/iodide	wt%	0	<0.1

(a) - As fed basis (wet)

(b) - Dry basis (as received)

Note: The information presented in this table is considered typical but should not be considered limiting.

Exhibit D – Information on Metal Components

Exhibit D - Information on Metal Components

Modern Custom Fabrication Drawing 1601794, Sheet 2 of 5:

$$\text{bottom of base ring extension A7 (support lugs) to bottom of T-18} = 4' 3" + 9' 4\text{-}3/4" = 13' 7\text{-}3/4"$$

Schwan Drawing 5094, Sheet S2:

$$\text{Top of T-18 structural steel support} = \text{EL } 169' 2" - 1\text{-}1/4" = \text{EL } 169' 0\text{-}3/4"$$

Schwan Drawing 5094, Sheet S3:

$$\text{Grade} = \text{EL } 115' 0"$$

$$\text{Distance from top of T-18 structural steel support to grade} = 169' 0\text{-}3/4" - 115' 0" = 54' 0\text{-}3/4" \text{ above grade}$$

$$\text{Distance from bottom of T-18 to grade} = 54' 0\text{-}3/4" - 13' 7\text{-}3/4" = 40' 5"$$

Bottom of T-18 is 40' 5" above grade; therefore no metal component of tank is in contact with the soil or with water.

APPENDIX IX

TAB 3

Certification of the T-Tank Containment Area

Revision 1
April 2012



June 12, 2006

Mr. Monte McCue
Director of Plant Operations
Siemens Water Technologies Corp.
2523 Mutahar
PO Box 3308
Parker, AZ 85344

Ref: Certification Of The T-Tank Containment Area

Dear Mr. McCue:

I have reviewed the T-Tank Containment Pad Plan for the Westates Facility, dated 2/11/06, and I am satisfied, using my judgment as a professional engineer, of the following:

1. The proposed containment pad is designed to be constructed with materials that are compatible with the spent carbon wastes to be placed into the tank system that the pad will serve, and will have sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrological forces), physical contact with the spent carbon, climatic conditions, the stress of installation, and the stress of daily operation (including stresses from nearby vehicular traffic).
2. The proposed containment pad will be placed on a foundation or base capable of providing support to the secondary containment system and resistance to pressure gradients above and below the system and capable of preventing failure due to settlement, compression, or uplift.

Regards,
Chavond-Barry Engineering Corp.



Louis T. Barry, P. E. (NJ: 24GE03567600)
President

CC: Stephen M. Richmond
Karl E. Monninger
Darwin M. Owens

SRichmond@BDLaw.com
KEMonninger@Chavond-Barry.com
Darwin.Owens@Patmedia.net

**T-TANK CONTAINMENT VOLUME CALCULATIONS
US FILTER WESTATES CARBON
PARKER, AZ**

CONTAINMENT VOLUME BELOW TOP OF PIERS					
	ELEV (FT)	DIFF ELEV (FT)	SURFACE AREA (SF)	AVE AREA (SF)	GROSS VOLUME (CF)
TOP OF GRATE	10.60		8.00		
		0.07		20.49	1.43
	10.67		32.97		
		0.04		45.39	1.82
	10.71		57.81		
		0.13		246.37	32.03
	10.84		434.92		
		0.03		486.21	14.59
	10.87		537.50		
		0.21		769.04	161.50
	11.08		1,000.57		
		0.92		1,000.57	920.52
TOP OF PIER	12.00		1,000.57		
GROSS VOLUME TOTAL =					1,131.89
LESS PIER VOLUME =					45.10
LESS STEP VOLUME =					8.56
NET VOLUME TO TOP OF PIERS =					1,078.23

PIER VOLUME						
	TOP ELEV	AVERAGE BOTTOM ELEV	AVERAGE HEIGHT (FT)	SIZE (FTxFT)	SURFACE AREA (SF)	VOLUME (CF)
PIER #1	12.00	10.69	1.31	2 X 2	4.00	5.24
PIER #2	12.00	10.78	1.22	2 X 2.5	5.00	6.10
PIER #3	12.00	10.78	1.22	2 X 2.5	5.00	6.10
PIER #4	12.00	10.87	1.13	2 X 2	4.00	4.52
PIER #5	12.00	10.87	1.13	2 X 2	4.00	4.52
PIER #6	12.00	10.87	1.13	2 X 2	4.00	4.52
PIER #7	12.00	10.97	1.03	2 X 2.5	5.00	5.15
PIER #8	12.00	10.97	1.03	2 X 2.5	5.00	5.15
PIER #9	12.00	11.05	0.95	2 X 2	4.00	3.80
TOTAL FOR PIERS=					40.00	45.10

STEP VOLUME OCCURS BELOW TOP OF PIERS:

STEP VOLUME = 1.07 SF X 8 FT = 8.56 CF

TOTAL STEP VOLUME (ALL BELOW TOP OF PIERS) = 8.56 CF

NOTES:

1. FOR EASE OF CALCULATION AND BEING CONSERVATIVE, ASSUME PIER SURFACE AREA REMAINS CONSTANT TO ACCOUNT FOR THE SUPPORT STEEL
2. RESULTANT SURFACE AREA TAKING OUT PIER SURFACE AREA= 1,000.57 SF - 40 SF = 960.57 SF

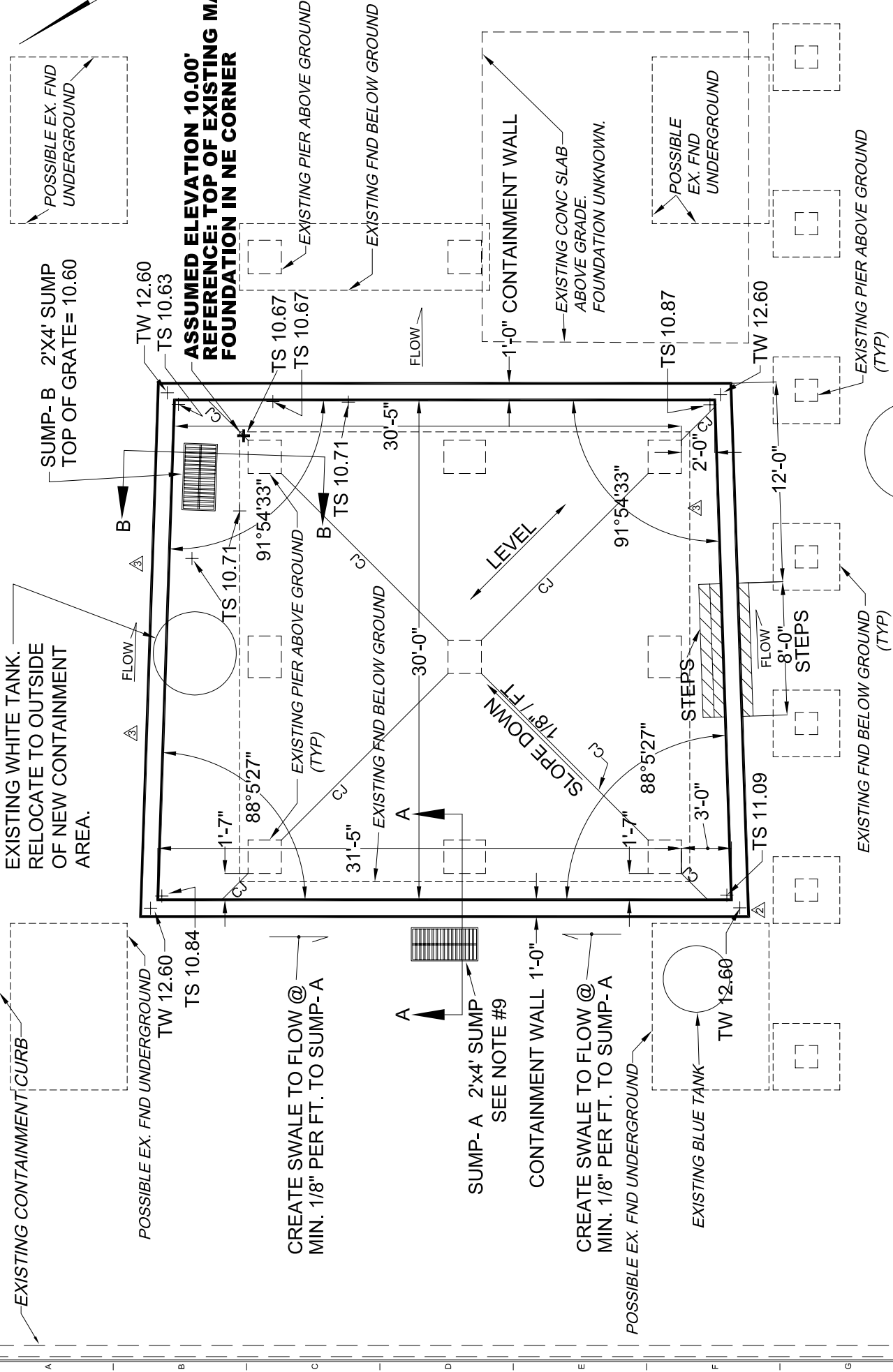
CONTAINMENT VOLUME ABOVE TOP OF PIERS							
	ELEV (FT)	DIFF ELEV (FT)	SURFACE AREA (SF)	AVE AREA (SF)	VOLUME (CF)	CUMULATIVE VOLUME (CF)	CUMULATIVE VOLUME (GAL)
TOP OF PIER	12.00		960.57			1,078	8,065
		0.60		960.57	576.34		
TOP OF WALL	12.60		960.57			1,655	12,376
TOTAL CONTAINMENT VOLUME TO TOP OF WALL =						12,376 GALLONS	

T-TANK CONTAINMENT VOLUME REQUIRED			
LARGEST RCRA TANK VOLUME=			
8,319 GALLONS			
25-Year, 24 Hour Rain Event (PARKER, AZ) = 2.45 inches (Per ASU Office of Climatology)			
GROSS SURFACE AREA (SF)	RAIN DEPTH (INCHES)	VOL (CF)	VOL (GAL)
1,000.57	2.45	204	1,528
TANK VOLUME=		8,319 GALLONS	
RAINFALL VOLUME=		1,528 GALLONS	
TOTAL REQUIRED VOLUME=		9,847 GALLONS	

NOTES:

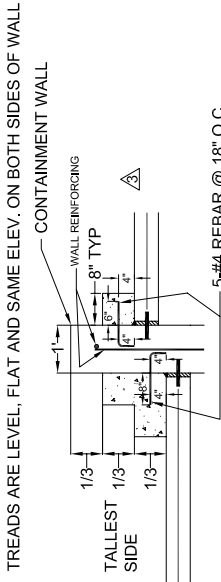
1. A FIELD SURVEY WAS NOT PERFORMED FOR THIS WORK. THE EXISTING CONDITIONS INFORMATION SHOWN HEREON WAS OBTAINED FROM 2 SETS OF PLANS AND SITE PHOTOS PROVIDED BY THE OWNER. THE 2 SETS OF PLANS ARE:
1) THE FOUNDATION LAYOUT PLANS TITLED "WESTATES CARBON, LOS ANGELES, CA 90040" FOR PROJECT IN PARKER, AZ, PREPARED BY GMG ASSOCIATES, DATED 3-17-92 WITH LATEST REVISION "B" 3-23-92, DRAWING NO. D 9201-401 AND D 9201-402.
2) PLANS TITLED "USFILTER WESTATES SURVEY OF CONTAINMENT VOLUME" PREPARED BY LEMME ENGINEERING INC., DATED 9-5-02 SHEETS 1&2 OF 5.
2. THE CONTRACTOR IS TO REVIEW THE SITE AND IT'S CONDITION BEFORE PROVIDING A PRICE AND AGAIN BEFORE BEGINNING CONSTRUCTION.
3. THE CONTRACTOR IS TO MOVE/RELOCATE ALL ITEMS AS NECESSARY TO DO THIS WORK. THE OWNER WILL INSTRUCT THE CONTRACTOR AS TO WHICH ITEMS HE WILL BE RESPONSIBLE FOR MOVING/RELOCATING DURING CONSTRUCTION AND WHICH ITEMS ARE TO BE MOVED BACK INTO THE CONTAINMENT AREA AFTER CONSTRUCTION.
4. THE CONTRACTOR IS TO REMOVE THE EXISTING CONCRETE CONTAINMENT PAD IN ITS ENTIRETY FROM THE AREA WHERE THE NEW PAD IS TO BE CONSTRUCTED. CONTRACTOR IS NOT TO DAMAGE THE EXISTING PIERS AND UNDERGROUND FOUNDATIONS.
5. THE CONTRACTOR IS TO UNCOVER THE EXISTING MAT FOUNDATION AND HAVE AN INDEPENDENT TESTING FIRM EXPERIENCED IN CONCRETE TESTING INSPECT THE EXISTING MAT FOUNDATION TO VERIFY ITS CONDITION. THE TESTING FIRM IS TO PROVIDE TO THE OWNER A REPORT SHOWING THAT THE PAD CONDITION IS NOT DAMAGED PRIOR TO THE CONTRACTOR PROCEEDING WITH CONSTRUCTION.
6. SUMP-A&B: USE NEEVAH FOUNDRY FRAME & GRATE #R-1879-B8G 24"X48" LIGHT DUTY. GRATE COMES IN 2 PARTS
7. ALL CONSTRUCTION JOINTS ARE TO CONTAIN WATERSTOPS, EXPANSION JOINT MATERIAL AND CAULK.
8. ON BOTH SIDES OF THE CONTAINMENT WALL WHERE THE CONCRETE PAD MEETS THE WALL USE WATERSTOPS, EXPANSION JOINT MATERIAL AND CAULK.
9. SUMP-A TOP OF GRATE ELEVATION IS TO BE DETERMINED IN THE FIELD BY CREATING A SWALE ALONG THE CONTAINMENT WALL AT A MINIMUM SLOPE OF 1/8" PER FOOT FROM THE SW AND NW CORNER OF THE CONTAINMENT WALL SO THAT THE WATER DRAINS TO SUMP-A.

ASSUMED ELEVATION 10.00'
REFERENCE: TOP OF EXISTING MAT FOUNDATION IN NE CORNER



LEGEND

- TW 12.60 = TOP OF WALL ELEVATION
TS 10.67 = TOP OF SLAB ELEVATION
CJ = CONSTRUCTION JOINT



EXISTING WAREHOUSE BUILDING

CONTAINMENT PAD PLAN

SCALE: 1/4"= 1'

GRAPHIC SCALE

STEP DETAIL

NTS

PAINT VERTICAL FACES OF THE STEPS WITH YELLOW PAINT INCLUDING THE WALL WITHIN THE LIMITS OF THE STEPS.

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

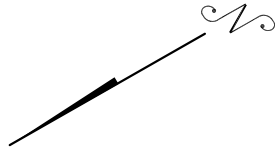
WATERSTOP

TOP VIEW

JT. SEALANT

EXPANSION JT. MATERIAL

WATERSTOP



SUMP-B: 2'X4' GRATE
TOP OF GRATE= 10.60

TS 10.63
TW 12.60

TS 10.67

ASSUMED ELEVATION 10.00'
REFERENCE: TOP OF EXISTING MAT
FOUNDATION IN NE CORNER

TS 10.71

PIER # 1
TS 10.69

TS 10.67

TS 10.67

TS 10.71

PIER # 3
TS 10.78

PIER # 5
TS 10.87

PIER # 7
TS 10.97

PIER # 9
TS 11.05

PIER # 8
TS 10.97

PIER # 6
TS 10.87

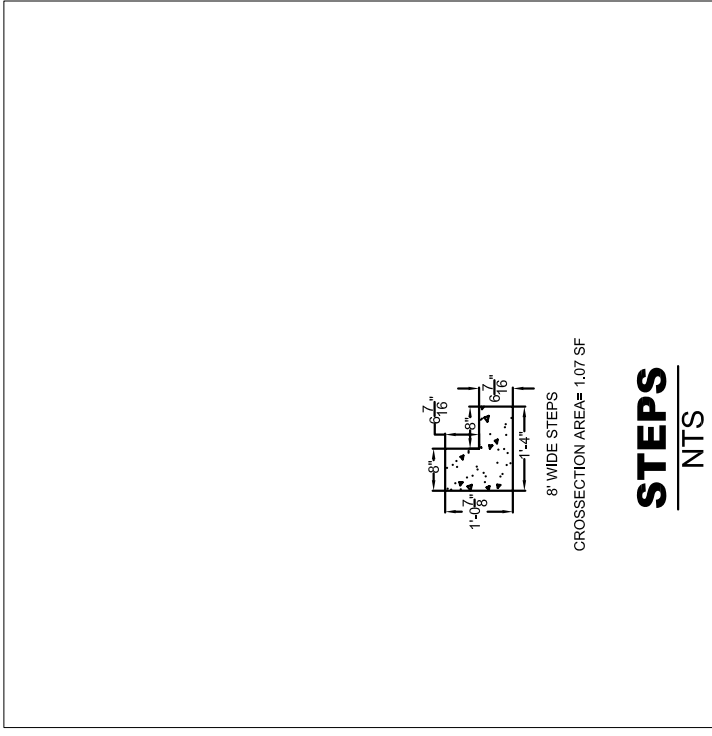
TS 10.87

TW 12.60

TS 11.09

TW 12.60

TS 10.84



CONTAINMENT VOLUME CALCULATION PLAN

GRAPHIC SCALE

SCALE: 1/8"=1'

